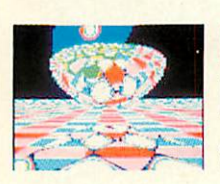
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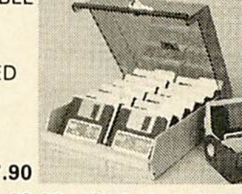
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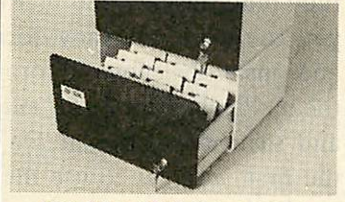
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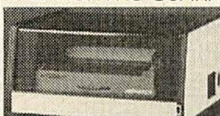
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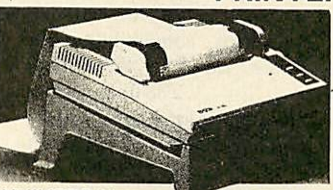
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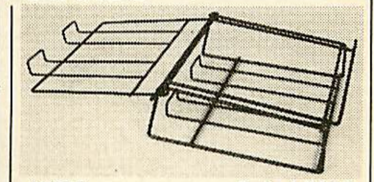
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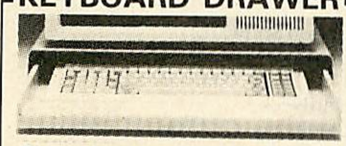
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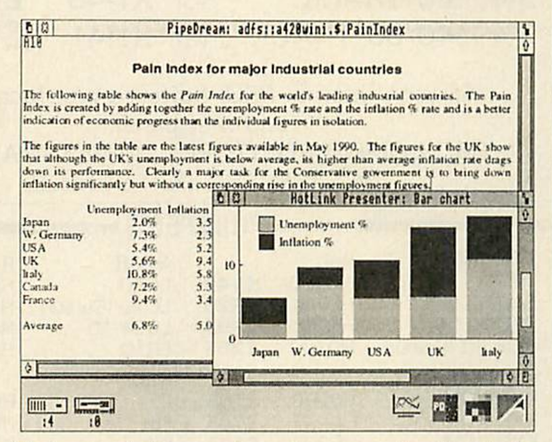
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colton software

PipeDream 3 breaks down the barriers between word processor, spreadsheet and database. With PipeDream 3, you can include numerical tables in your letters and reports, add paragraphs to your spreadsheets, and perform calculations within your databases.

PipeDream 3 has been written to take full advantage of RISC OS – if you can use RISC OS, you can use PipeDream 3. It is fully multi-tasking and multi-windowing, so you can work on many documents at once and instantly move information between them. PipeDream 3 can automatically load and save most popular file formats and is the first program to use the new RISC OS HotLink, which enables it to interact dynamically with Archimedes graphics programs, such as *HotLink Presenter* from Lingenuity and *GraphBox* from Minerva.

As well as winning the 1989/90 BBC Acorn User Award for Best 32-bit Business Software, PipeDream 3 was runner-up in the Best 32-bit Educational Software and Best 32-bit DTP/Word Processor categories.

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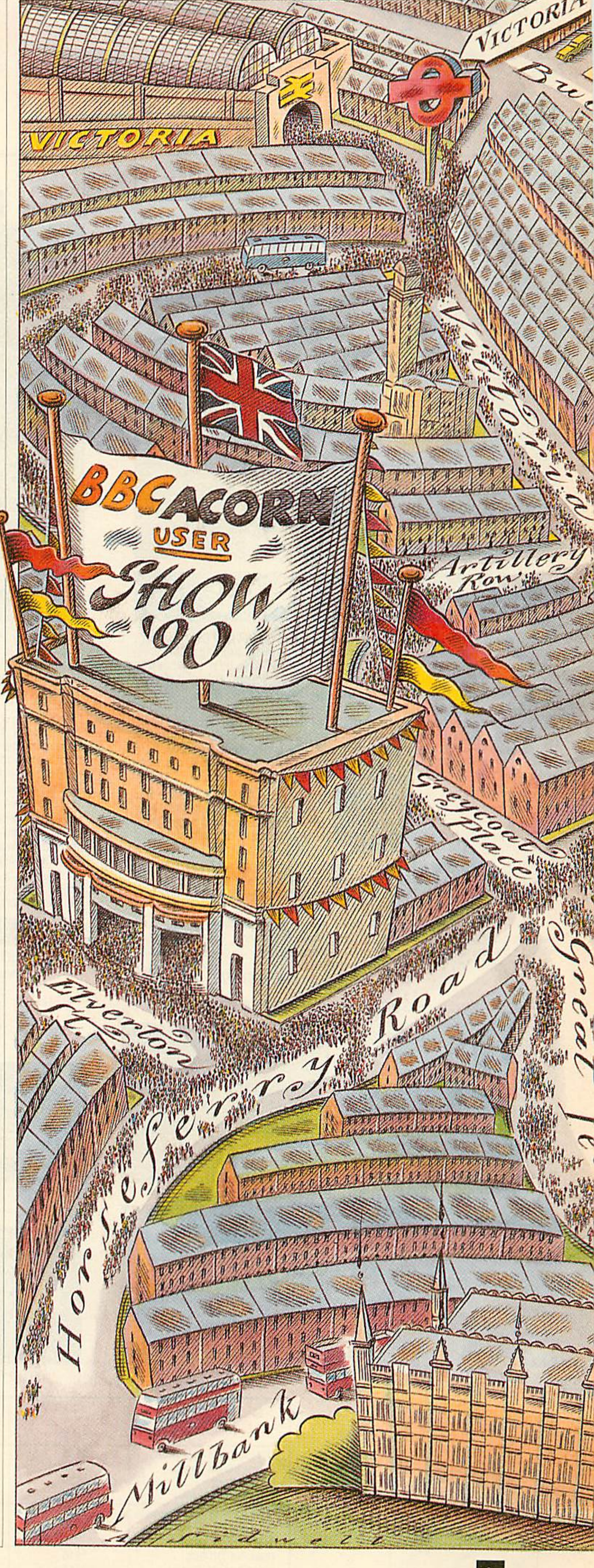
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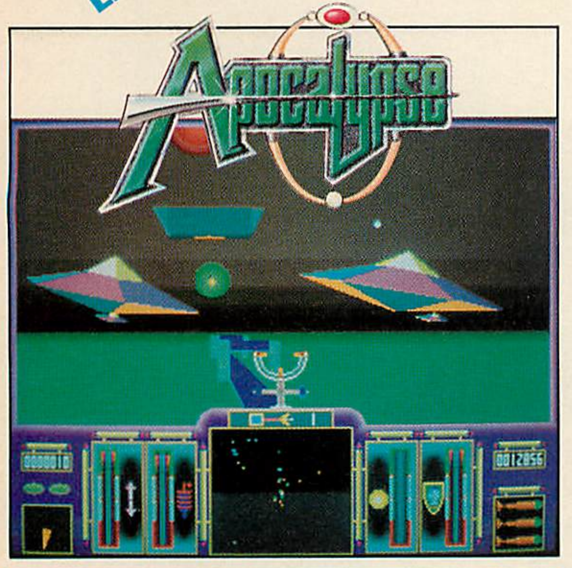
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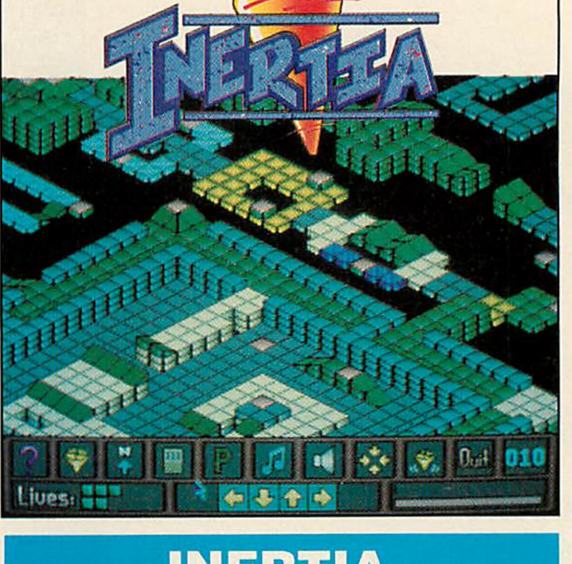
SEPTEMBER 1990 ISSUE No 98

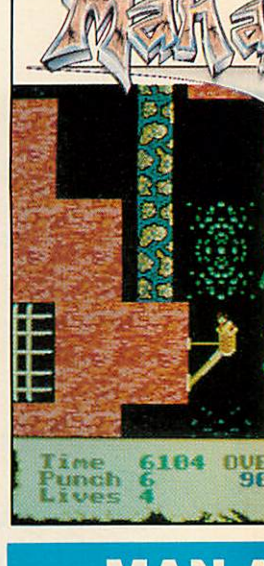


THE 4TH

A3000 ARCHIMEDES BBC B/MASTER ELECTRON







APOCALYPSE

Apocalypse is designed purely for the Archimedes. Utilising the machine's colossal processing power combined with ingenious programming techniques, the author has created a masterpiece which could not have been produced on any other home computer. The author is of course Gordon Key who already has Holed Out and E-Type under his belt. Apocalypse is by far his best work to date.

The game places you on the surfaces of varied futuristic hostile planets colonised by ruthless enemies. With your highly advanced craft you must find your way around the planets and systematically annihilate the enemy. Your ship, which can fly or move along the ground, is extremely fast and can even fight whilst hurtling backwards.

The graphics are truly unbelievable. The solid, shaded 3 dimensional buildings and objects are animated more quickly and smoothly than ever before. If you shoot at them they explode in a way that is terrifyingly real often catching fire before bursting into a ball of flames accompanied by devastating sound effects.

Initially Apocalypse is easy enough for a beginner to enjoy but as you progress your foes will become increasingly hostile and you will discover fascinating new objects. These can have strange properties and many may need to be destroyed. It will be up to you to discover how.

The Royal Guild of Spacing will monitor your progress as you play. Your performance will be assessed at appropriate times and you will need to impress them if you are to continue your adventure. Apocalypse is an amazing game. There's only one way to describe it....

RAW EXCITEMENT.

PRICE: A3000/Archimedes £29.95


A3000/ARCHIMEDES


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INERTIA

Inertia is a totally original game with a huge landscape just waiting to be explored. It is available for the Archimedes, BBC Micro and Acorn Electron. Scattered (or rather fiendishly placed) around the landscape are many special tiles which need to be collected. Your highly sensitive craft floats freely around the landscape and you must exert forces upon it to guide its speed and direction.

You have a 3 dimensional viewpoint displaying a tiny fraction of the total playing area. There are walls, bridges, tunnels and ramps to negotiate and a host of mystery tiles with strange properties indeed. These include ice, jump and transformation tiles. There are even certain tiles which alternate the controls so that everything works in reverse.

This massive game has been very carefully put together and solving the puzzles within it will need lateral thought and a lot of dexterity.

The Archimedes version is considerably enhanced with digitised sound and music. It even features a full colour 3 dimensional map of the game which is a joy just to wander around. You'll certainly be amazed at the size of the game and the variety within it.

Inertia is a game for the determined. Each version makes full use of the ability of the computer so make sure you've got plenty of time to spare. Once you have started you won't be able to stop.

Electron User Golden Game May'90

*BBC Micro and Acorn Electron versions available **NOW**.*
Enhanced Archimedes version available in June, 1990.

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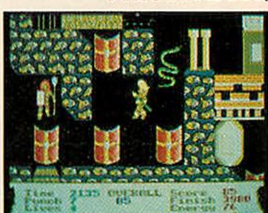
MAN-A

In the age when the castle was supreme it took dedicated warriors to overcome their defences, to loot and pillage, and finally to destroy.

You are armed with a mighty sword cast from the remains of a thunderbolt which fell from the sky many millennia ago. Also in your possession is a magic potion which makes you invincable to all for short periods of time. Armed with these you must penetrate the inner recesses of 4 castles and do battle with all you find in them.

As you progress you will discover many intriguing objects which can behave very strangely. Many are documented such as wooden panels, hour glasses, thorns, portculli, mirrors etc.. But most are

PRICE: A3000/


A3000/ARCHIMEDES


A3000/ARCHIMEDES

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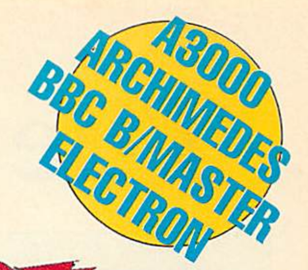
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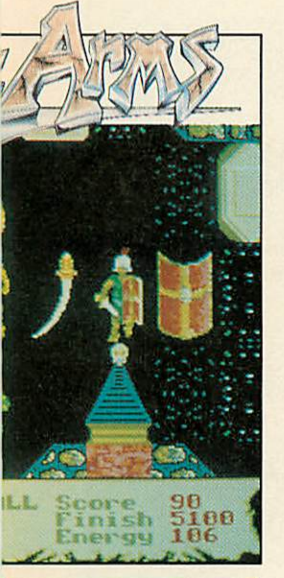
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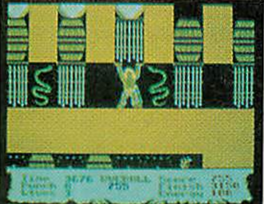
-ARMS

not. When you think your stuck, experiment and you'll discover properties you never knew existed.

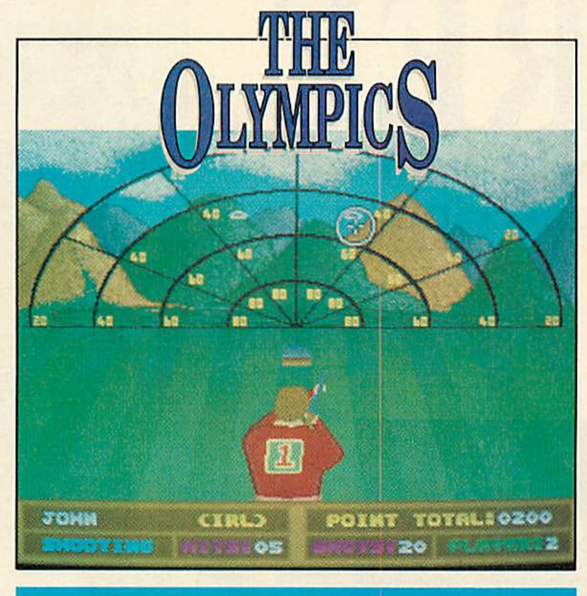
The subtle blend of arcade timing and adventurous puzzles make Man-At-Arms fiendishly addictive. You must plunder each of the 4 castles which become increasingly "puzzling" as you progress. Your overall objective is to kill all foes with your mighty sword and to plunder as much of the most valuable treasure as you can carry.

Man-At-Arms is a fascinating challenge with superb sound effects and music. No attention to detail has been spared and you can be sure of many late nights for weeks to come.

himedes £19.95


A3000/ARCHIMEDES


A3000/ARCHIMEDES



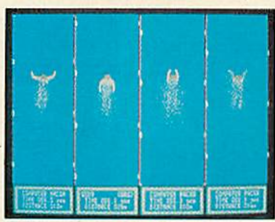
THE OLYMPICS

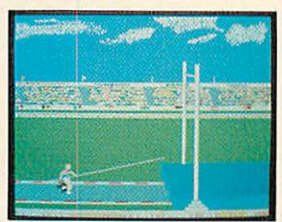
The Olympics is an experience which can be played by 1 to 8 players. It contains a superb piece of music, opening and closing ceremonies and 14 national anthems. When a player wins a gold medal the national anthem for his chosen country is played. Any World Records that you achieve can be saved to disc. With the click of a button all the relevant information concerning the record is automatically saved including your name, the exact time, day and date!

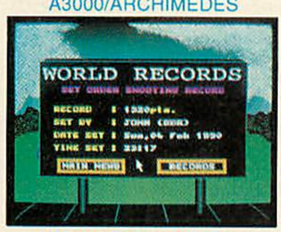
It is comprised of 6 main events: Diving, Shooting, Javelin, Swimming, Canoeing and Pole Vault. Some of these have several "sub-events" to choose from - there are 2 Shooting events, 12 Swimming events and 3 Canoeing events. These events have been chosen for maximum variety and enjoyment. They will "extract" all sorts of abilities: manual dexterity, timing, memory, perserverance, adaptability and above all guts!

The menu systems are controlled entirely with the mouse. As such they are extremely easy and quick to use. All events can be practiced or competed in individually, or altogether for maximum Gold, Silver and Bronze medals. You can also play all 6 events as a sort of "hex-athlon" where points are awarded for each event - the player with the greatest number of points is deemed to be the winner.

PRICE: A3000/Archimedes £19.95


A3000/ARCHIMEDES


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NEVRYON

This fast arcade game is disc based only and boasts 100K of graphics and game code for the BBC and 2 discs of over 1.5 megabytes for the Archimedes. It is a fast sideways scrolling shoot'em up which features 8 levels of furious opponents and very varied and very detailed graphics.

You fly a spaceship which can attain immense firepower - more lasers, a ram, gun droids and highly destructive missiles which are released from the top & bottom of your ship, then ignite and shoot forwards.

Whilst the BBC version is superb, the Archimedes version has been considerably enhanced and is truly exceptional putting many arcade games to shame. Nevryon uses the machine's raw power to full effect and gameplay is second to none.

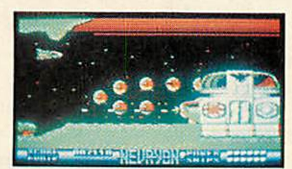
It comes on 2 discs and features 5 true levels of parallax scrolling, more than 50 objects on screen, over 1 megabyte of 256 colour graphics, digitised stereo sound and music etc. etc.. You control a different ship on each of the 4 scenarios and there are a seemingly infinite number of weapons to collect and use. End of level monsters are beautifully animated but are anything but friendly.

BBC Review: "Graphics are very colourful and hectic, with explosions, missiles and aliens all heading for your ship. Together with a scrolling landscape, complete with stars moving in the background, they combine to form an enjoyable and action packed game." Micronet, Feb'90.

*BBC Micro version available **NOW**.*
Enhanced Archimedes version available in June, 1990.

PRICE:

A3000/ Archimedes	**£19.95**
BBC B/Master 5 1/4" disc	**£14.95**
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BBC B/MASTER


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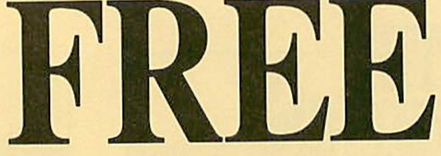
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The programs published in each magazine, plus additional bonus items are also available on disc.

And here are some of the articles and series you missed in the last few months:

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R&D MAN QUITS



Steve Furber – who, with Roger Wilson, developed and engineered the Arm chip set – is to leave Acorn this month. He is due to take up a new appointment – the ICL Chair of Computer Engineering at Manchester University.

Furber and Wilson's work on the Arm chip set forms the basis of the current Acorn range.

Furber's departure from Acorn could affect the company's R&D activity, at least in the short term. And since Furber will be taking his knowledge in Arm with him, might we see further Arm-type developments outside the Acorn arena?

SPREAD THE WORD

Schema is a new spreadsheet software package currently being developed by Acorn for the Archimedes and A3000.

It is a Risc OS multi-tasking application with advanced statistical and financial features, using a Wysiwyg display. *Schema* can be tailored for individual needs by using a macro support facility.

Spreadsheet size is 32,000 columns by 32,000 rows. Multiple spreadsheets can be linked together, and functions for graphs and charts will be included. Printer support with draft and final copy is allowed, and all standard Risc OS printer drivers are also supported.

The price is to be announced.

NEW ARC PLANNED

Acorn is thought to be working on an Arm 3-based machine which will sit at the top of the Archimedes range.



The new machine's model number is yet to be announced, but it is believed it may be available later this year.

It will be equipped with an Arm 3 chip running at 30Mhz. The chip would operate at between 10 and 12 MIPS – that is three times faster than the current Archimedes machines.

The machine will come with 4Mb of fast Ram, a large internal hard disc, a single floppy drive, video options, larger PSU and a SCSI controller as standard, leaving three free slots.

No price has yet been fixed, but we believe that the machine will probably cost £1000 more than the A440.

It will be possible to expand on-board memory up to 16Mb with 4Mb memory expansion cards that are fitted with a Memc 1A memory controller chip.

The motherboard will incorporate a CPU slot, and Acorn is also working on a plug-in Arm/floating-point unit board, which should be available with a possible rating of 50Mhz. The machine will have some similarities to the hardware specification for the R260 Unix workstation, launched in June.

The casing will be the same as the 400 series, but with a new motherboard with two thermostatically controlled fans.

The new computer is intended by Acorn to be the first in a series of Arm 3-based Archimedes machines.

No further details are available yet, but a similar machine without the hard disc could be a logical successor.

COMPUTER MISUSE ILLEGAL

The Computer Misuse Bill has become law. Unauthorised access to computer systems will now become a criminal offence, which will be punishable by either imprisonment or fines.



According to Michael Colvin, the MP responsible for sponsoring the Bill, the new laws will 'bring Britain in line with the rest of Europe, where legislation to deal with hackers has already been implemented.'

The laws will come into effect on August 29. Three new criminal offences are covered:

- unauthorized access to computer material.
- unauthorized access with intent to commit or facilitate further offences.
- unauthorised modification of computer material.

The first type of offence covers 'simple hacking' and carries a fine of up to £2000. The second covers actions such as blackmail, with a penalty of up to five years in jail. The third type of offence carries the same penalty.

The latter two offences will be tried in front of a jury.



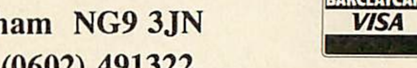
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* The Multi Sync Monitor is the Taxan 775

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When you purchase an Archimedes Micro from us, we will donate 10% of the Archimedes Hardware cost towards other goods. For example, for purchasing an A3000 Learning curve colour system, you could choose to have a 1Mb RAM upgrade fitted, giving you a powerful 2Mb machine. Please phone for further details

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ARC CD ROM

The Next CD-Rom drive system for the Archimedes and A3000 which was shown for the first time at BETT 90 last January, is now on sale.

Developed by Acorn and Cambridge-based Next Technology, the system costs £1144, or £914 for educational orders.

The complete package includes the drive, CD interface card with cabling, CDFS software for Risc OS and documentation. The drive is also supplied with a sample resource disc included.

Each system will also come with a £50 voucher which can be traded against Next Technology's 'Pressed for Time' disc pressing service. The facility allows users to generate a single CD-Rom for £170.

Contact Next Technology on (0223) 421180.



ACORN PROPS UP MODEL B

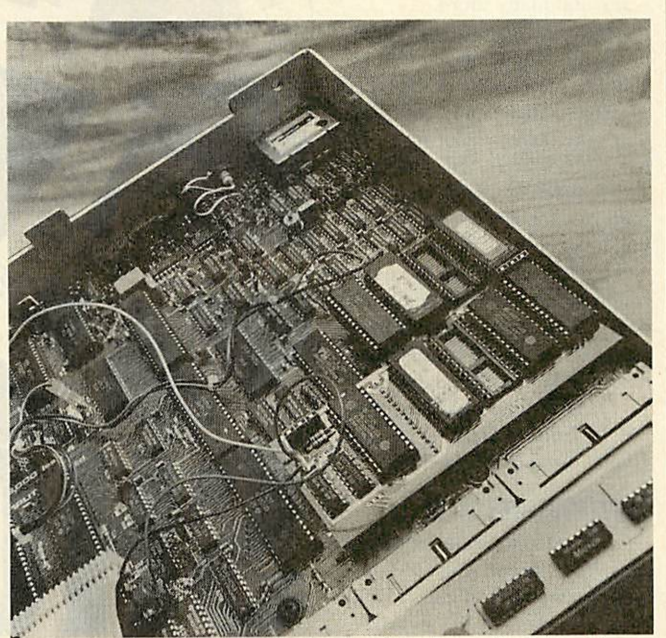
Acorn Computers has committed itself to supporting the BBC model B 'while the requirement for the machine exists'.

Acorn says it has recognised that even though the BBC model B is no longer in production, it needs to support the machine for some time to come because it is so firmly established.

The company intends to supply, through its dealers, all major parts for the Beeb, including power supplies, Roms and ICs for at least two years.

The exceptions are model B keyboards and keyswitches. According to Acorn these items have become increasingly difficult to obtain, and there are limited stocks available.

In order to ensure that model B keyboards can be maintained, Acorn has organised a centralised repair, refurbishment and exchange service, run by Bedford Technical Engineering.



Acorn itself has now ceased selling keyboards and keyboard parts directly to dealers.

Users wishing to have their keyboards repaired should contact their local Acorn dealer, who will be able to offer a repair or replacement service.

MORE FOUNDRY FONTS

The Electronic Font Foundry has agreed with the Postscript specifier, Adobe, to match the relevant Postscript fonts. It has already converted 13 of its fonts so far. The rest will follow over the next three months.

Electonic Font Foundry fonts are available as separate font families, ranging from £9.95 to £33, or as font packs of up to 17 fonts from £45 to £69.

● The Electronic Font Foundry has also released 17 'designer' fonts 'to give a creative option to Archimedes DTP users'.

Oxford	Optima
Poster	Bodoni Poster
Royal	ITC Souvenir
Sophie	Park Avenue
Sulikow	ITC Bauhaus
Swiss	Helvetica
Tamsin	Brush Script
EFF_Times	Times

IMAGE ANALYSIS

Foster Findlay Associates has released *Arcimage*, a suite of interactive image processing and analysis software for the Archimedes. The company has also released a set of C function libraries for the Arc.

Both sets of code are configured to work with the Hawk V10 framestore from Wild Vision, which plugs into the Arc.

Arcimage is a standalone image processing and analysis suite that provides icon selectable functions for a wide range of applications.

C_Image is a software toolkit designed for more complex applications. 200 functions are currently available with extensions available for colour image analysis.

C_Image and *Arcimage* cost £575, and *Arcimage* alone costs £402.50. Foster Findlay also offers a consultancy service.

Contact Foster Findlay on 091-273 1111.



JOIN IN THE FUN

The *BBC Acorn User* Show 90 is the place to be. As a Beeb or Arc owner, you can join fellow enthusiasts at the show, which takes place at London's Westminster Exhibition Centre (see map) on September 7 – 9.

Besides good company, you will find all the latest products for your micro, many of them at special show prices. Keep a special look-out for discounts from Clares, Watford Electronics, Beebug, Pineapple Software, and many more.

There will be numerous demonstrations held on exhibitors' stands, and they will be very pleased to answer any questions you may have concerning particular products. In fact, the show provides the perfect opportunity for you to 'try before you buy'.

To help you get to the exhibition, there will be a luxury coach travelling every 20 minutes from Victoria train station (take the Wilton Road exit).

Opening times of the show are 12 noon – 7pm (Fri) and 10am – 6pm (Sat and Sun).

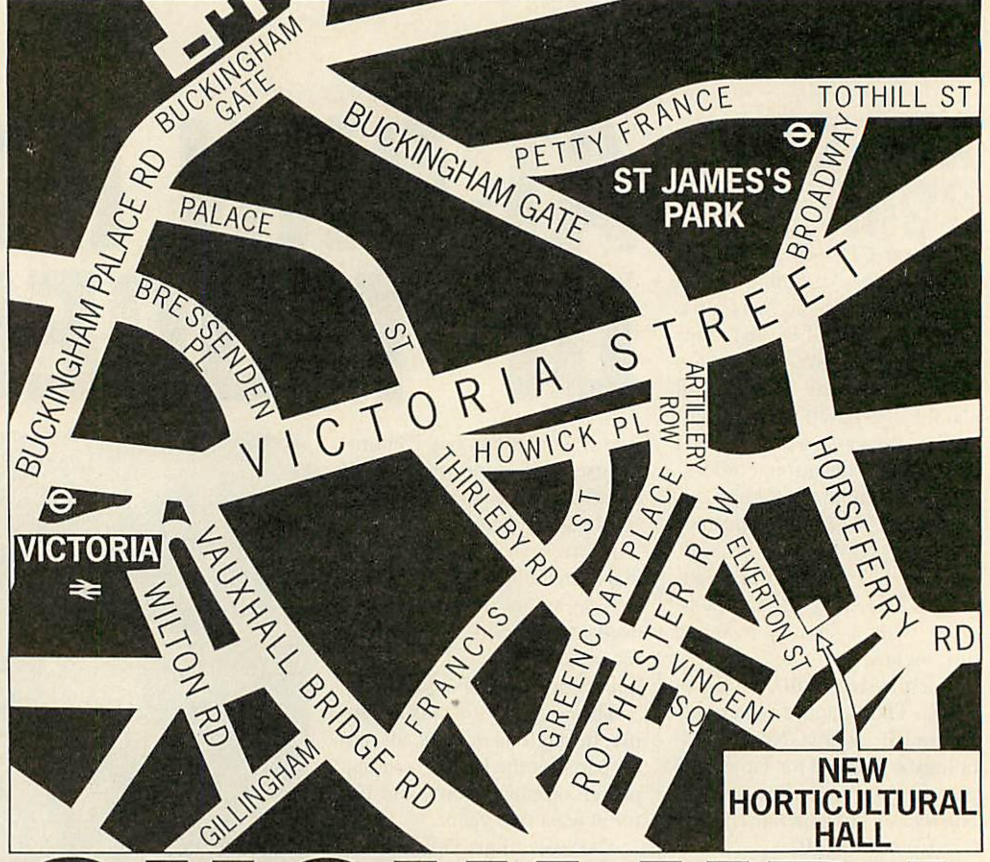
SEMINAR DETAILS

Among the major attractions at past *BBC Acorn User* Shows have been the seminars. Held by key figures in the industry, they give you the opportunity to keep up with the latest developments and techniques. Below is a brief resumé of the seminars, but you are advised to check the show catalogue, as details are subject to change.

Friday, September 7
- The National Curriculum in secondary schools
- Inspiration *midi sequencer*
- Multimedia and CD-Rom in Education

Saturday, September 8
- The *View* family
- Industrial sponsorship
- Choosing printers and monitors
- DTP on the Arc

Sunday, September 9
- The *Inter* family
- Networking
- Future trends of Risc
- Introducing the National Curriculum – an update on English requirements in primary schools
- Communications



SHOW UP!

MEET THE BAU TEAM

One of the major benefits of any *BBC Acorn User* Show is the chance for us to meet the readers. This year's show is no exception, as all the editorial team will be on the *BAU* stand (nos 56/58) throughout the show.

If it's technical help, or just a query regarding something you've read in the magazine, then pop along and talk to us.

All the staff and regular freelancers will be on hand to offer advice. You will also have the chance to obtain advance copies of the October issue.

Barry Monk, *BBC Acorn User*'s new editor, will also be on hand. He'd like to hear what you think of the magazine.

MORE LAUNCHES

A *BAU* Show of such magnitude is used by many manufacturers and distributors to show off their latest wares. Here is a selection of goodies that will appear for the first time.

- Hotlink Presenter from Lindis International features direct data exchange. This allows *Presenter* and *Pipedream 3* to automatically update each other in real-time on screen. Lindis will have Snapshot, its version of the Hawk V9 colour digitiser on show. And it will show what it claims is the only internal SCSI board for the BBC A3000.
- Clares will be launching *Interdictor 2*, which you can see demonstrated on a giant TV screen in the theatre.
- AVP is exhibiting a new series of science lessons that have been developed in association with Somerset LEA.
- Morley will have a new disc drive for the A3000 with a 16-bit interface added to the drive for fast access speeds. 20Mb and 40Mb versions will be on show.
- Computer Concepts will launch *Impression 2* and *Junior* DTP packages.
- Dabhand Computing has range of calculator and file utilities and a file transfer utility.
- Electro Music Research should draw crowds with Mike Beecher demonstrating his latest version of *Studio 24 Plus*. For use with Studio 24 is a new program called *Dreamwave* – a 32 harmonic wave synth using the Arc sound system.
- Data Design will have *Designer Logic* and *Designer Castles* on show. The former allows you to construct and experiment with logic gates.
- Watford Electronics should have the Ultimatum Podule Racking System for the A3000. It's a plinth unit with four podule slots and can accommodate an optional hard disc interface. Check the WE stand to see if it has an Arm 3 upgrade!



COME TO THE BBC ACORN USER SHOW AND WIN £1000 WORTH OF PRIZES

The *BBC Acorn User* Show is the largest and most exciting annual event for all Beeb and Arc users. Our news pages should give you a few good reasons why you should not miss this event – but we can give you another incentive.

In conjunction with Acorn and some of the other leading exhibitors at the show, *BAU* is offering you the chance to win software and peripherals worth over £1000. All you have to do is fill in the coupon below and bring it along to our stand at the show. Your coupon will be entered into our free prize draw – and you stand a chance of winning one of the many prizes on offer.

Prizes from Acorn include copies of:

- *Desktop Publisher*
- *First Word Plus*
- *PC emulator*

Other leading exhibitors at the show will also be contributing prizes of other software and useful peripherals for both the Beeb and Arc.

The free prize draw is open for the duration of the show and the winners will be selected and notified as soon as possible after the show ends.

So be sure to bring your coupon along to the show – you could end up being a winner!

Only one coupon per person is permitted. Prizes will be allocated in order of value by the judges. The judges' decision will be final and no correspondence will be entered into. There are no cash alternatives to any of the prizes. The draw closes on September 9 1990.



You could be the lucky winner of Acorn's Desktop Publisher or one of many other prizes

BBC Acorn User Show Free Prize Draw

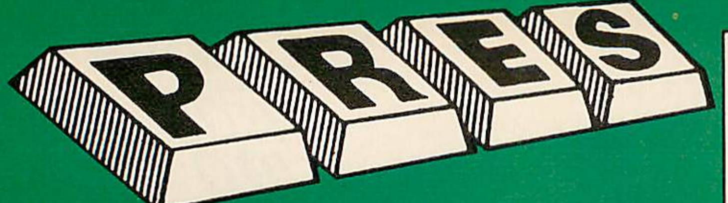
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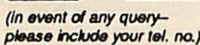
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GRANADA HELPS THE R140

Third party computer maintenance company, Granada Microcare, has set up a help desk for Acorn's R140 Unix workstation users.

The help desk allows users to talk through problems with trained staff. The help desk is based at Microcare's technical engineering centre in Bedford and is manned during normal office hours.

Microcare currently uses a mainframe and R140 local area network-based workstation to store information on site.

This is being upgraded with external 330Mb SCSI disc drives that will act as the main storage medium.

For more information contact Microcare on (0234) 226868.



RETAIL MOVE

In an effort to further strengthen its market position, Acorn has created the new post of retail sales manager, which is being filled by Ian Munro.

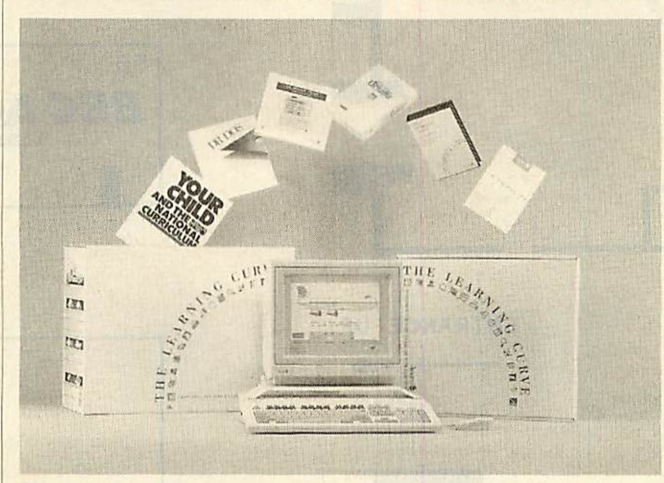
Munro's role will be to maintain and develop Acorn's trade and distribution channels, which currently include Dixons, Alders and John Lewis.

ERRATA

The news story in the August issue regarding Active Book Company carried the wrong telephone number. The correct number is (0223) 355144.

● In the same issue; the news story 'Interactive A3000 Video' referred to a company called AIP. This should have read Allied Interactive.

LEARNING CURVE COMPETITION WINNER



We are proud to announce a winner to the Learning Curve competition which was set in the June issue.

The competition attracted over 1000 entries, all eager to win the prize, valued at £1000.

After rifling through the accumulated mountain, the editor eventually surfaced with details of the winner.

Our congratulations go to Adrienne Knight of the Old Kent Road, London.

Adrienne is now the proud owner of the Learning Curve package which consists of a 1Mb BBC A3000 and Acorn colour monitor.

Also included in the prize is £200 worth of software, including *Genesis*, *First Word Plus*, *PC Emulator*, a video and instruction manuals.

When informed of her good fortune, Adrienne said, 'I'm delighted, I was considering buying a wordprocessing system, but I won't need to bother now I've won.'

In order to win, Adrienne had to match the names of seven famous fictional characters with the schools they attended.

The correct answers are:

- Tom Brown, Rugby
- Pug, Bash Street
- Tucker Jenkins, Grange Hill
- Billy Bunter, Greyfriars
- Jennings, Linbury Court School
- Nicholas Nickelby, Dotheboys Hall
- Molesworth, St Custards

The two red herrings were Mill Hill and Little Oaks. The former was the ex-editor's school, and the latter, well from little oaks....

● The winner of the readers' survey competition will be announced in the October issue of *BBC Acorn User*.

NEW VDU RULES

The European Community has adopted rules concerning the use of visual display units at work. These include rights to periodic breaks and regular eye tests.

The EC action comes in the form of a directive, which requires each member government to adopt legislation by 1992. Even though Britain abstained from the unanimous decision to adopt the rules, they will apply, in part, after 1992.

The rules also call for glare-free and swivelling screens, adequate spacing between characters and lines and adjustable seats with a footrest if requested.

NEWS IN BRIEF

● Circle Software has released three new *Premier* application packages, and restructured its pricing.

***Premier* now costs £119.25. The three applications are an improved wordprocessor, database and a letter filing system. Applications cost £28.75.**

Earlier versions of *Premier* can be upgraded to V3.1 at no cost.

Circle Software can be contacted on (0793) 770021.

● *FontFX*, the Risc OS utility from Data Store that creates Draw files using outline font definitions, has been upgraded.

Version 4.00 can handle larger numbers of fonts, a shadow direction facility and a built-in preview window.

***FontFX* costs £9.95 plus 50p p&p. Upgrades are free by sending the original disc back with a 20p stamp.**

Data Store can be contacted on 081-460 8991.

● Database Software is currently developing Fun School 3.

Age groups for Fun School 3 have been structured to fit in with the National Curriculum. Versions will be available for the BBC micro and Archimedes.

Database Software is on (0625) 859333.

DIARY DATES

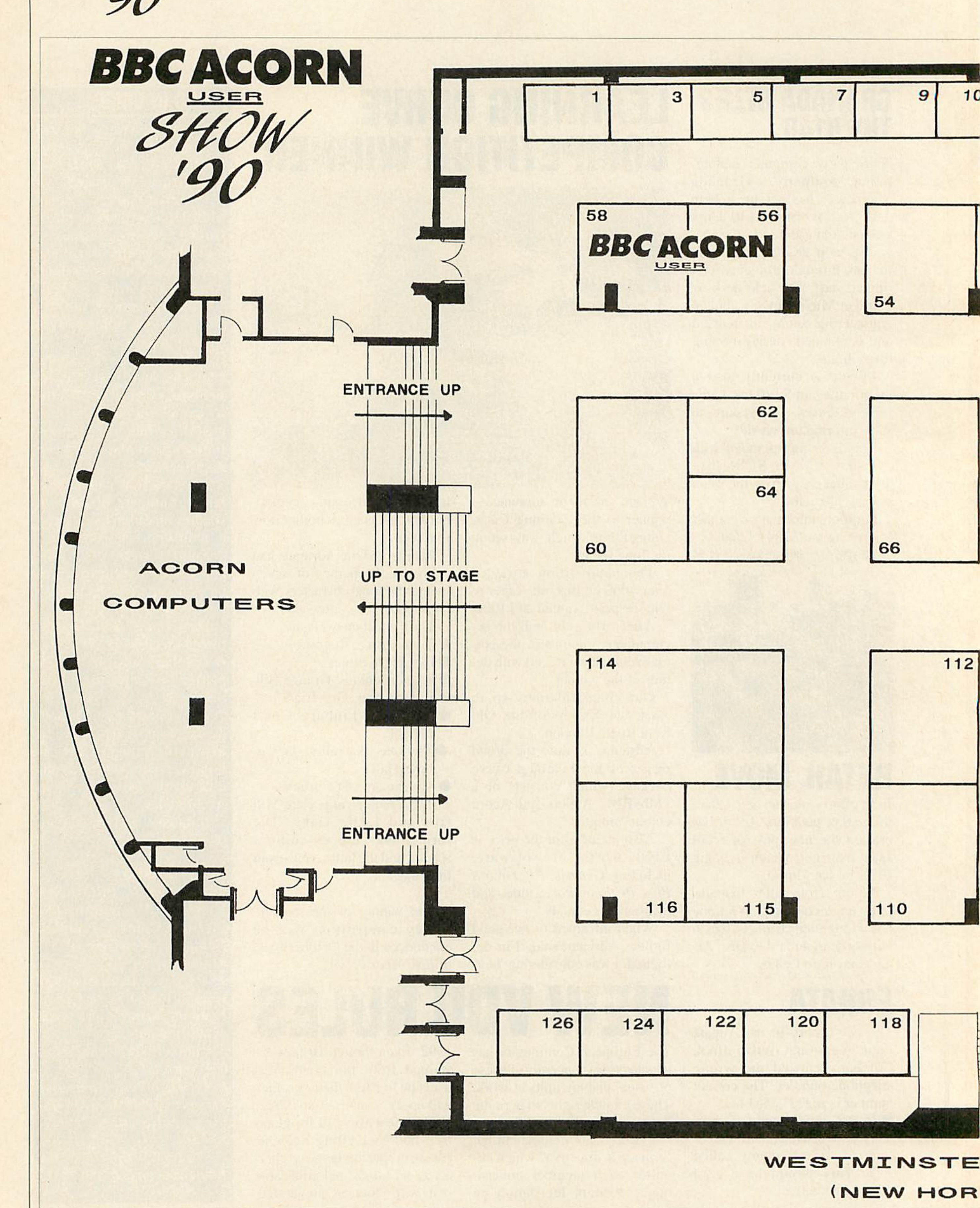
***7-9 September. BBC Acorn User* show, Westminster Exhibition Centre, London. Contact: Safesell on (0737) 814084.**

***25-28 September.* Business Computing 90, Earls Court, London. Business and trade exhibition only.**

Contact: Montbuild on 071-486 1951.

***6-9 December. Computer Shopper* 1990 show, Wembley Conference Centre, London.**

Contact: Cape Cowley Associates on 061-480 9811.


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BBC ACORN USER SHOW '90

EXHIBITOR LIST

Dias. Acorn Computers Ltd **1.** HSV Computer Services Ltd **3.** Schools Project **5.** Logic Sales Ltd **7.** Gaynor Hi-Tech Ltd **9.** Spacetech **10.** Care & Morley Electronics **12.** LCL Educational Software **14 & 16.** Videk Ltd **18.** CDS Software **20.** HS Software **22.** MJD Software **24.** Micro Studio Ltd **26.** Cue Video **28.** Schools Project **30.** Rickitt Educational Media **32.** Cambridge International Software **34.** AVP **38.** CJE Micros **44.** Paratex **46 & 48.** Calderglen Computers Ltd **50.** Weserve **52.** QD Enterprises Ltd **56 & 58.** BBC ACORN USER **60.** Minerva Systems **62.** Circle Software **64.** A & B Computing Magazine **66.** Lindis International & Wild Vision **68.** Watford Electronics **70.** Software Solutions & Ace Computing **72.** Fourth Dimension **74 & 76.** Beebug Ltd **78.** Electromusic Research **80.** Electronic Font Foundry **82.** Arxe Systems Ltd **84.** User Club Corner **90.** Orion Computer Services **96.** Pineapple Software **98.** Data Design **102.** NADI Systems **104.** Irlam Instruments Ltd **106.** Clares Micro Supplies **110.** Dabhand Computing **112.** Pres **114.** Computer Concepts **115.** Capricorn Consulting **116.** Colton Software **118.** 4Mation Educational Resources **124.** Ian Copestake Software **126.** Norwich Computer Services **127.** Mewsoft **128.** Nasa Promotions **129.** Topologika **130.** Corplan Computer Services **131.** Theatre

ARMCHAIR SHOPPING

Anyone remember Chris Curry, one of the co-founders of Acorn (along with Hermann Hauser)? Chris has not been idle since parting company with Acorn some time ago.

Indeed, if all goes well his online shopping service, Keyline Shopping, will be launched next year. Online shopping is not new – some have tried it in the past and failed. According to industry pundits, however, this will not happen with Keyline.

The idea behind the scheme is to let consumers enter their shopping lists on a terminal, pay for the goods using a smart card, and have them delivered to their home. Prior to launching the service, companies including Freemans, Kays, Littlewoods, Gateway Foodmarkets, WH Smith, Nat West and others have signed up for the service.

Customers pay a £50 sign-up fee for using the service, and the terminal is thrown in 'free'. After that, the only costs involved in the service are the price of the phone call to the Keyline computer. I don't know if Keyline will allow anyone access to the service with the customer's own terminal equipment, but I would expect so.



Telecom Gold users now have access to an environmental newsletter called Environment Briefing. Aimed at commerce and industry, it offers news on publications, and allows readers to build up their own reports. Question, why is Edwina Curry at the launch of the service, and is that a flash reflection on the screen, or a graphic of an egg? I think we should be told!

BIG BLUE

The UK domestic datacomms scene is about to receive a much needed boost from IBM.

Big Blue has released a range of entry-level 286-based PCs called the PS/1 series. Low in cost, they have high specifications and are bundled with lots of software. They're also equipped with a modem and viewdata-compatible software as standard, together with a special registration to Prodigy, a US viewdata service.

When the PS/1 family is launched in the UK, IBM will no doubt wish to offer UK punters a similar deal. My guess is that the company will organise a special registration offer with Prestel, the UK's national viewdata service.

What has this got to do with us Acorn owners, I hear you cry? Not much directly, but, in the long term, rather a lot. You see, IBM is pushing the PS/1 series in a big way, and expects to sell in the hundreds of thousands within a year or so.

The more the better I say, as there will be more people using modems and associated online services, and that has got to be good news for all online computer users.

GATEWAY NEWS

Regular readers will remember me wittering on about a gateway from Prestel to Telecom Gold. Micronet subscribers have had such a facility for some time, called Interlink.

The news is that the gateway (which can be accessed by all Prestel subscribers) now offers a scrolling terminal facility. In other words, you can use the gateway with conventional scrolling terminal software.

This development has been on the cards for some time now, and it means that Telecom Gold can be accessed on a local call basis by 90 percent of the population – providing they subscribe to Prestel.

To use the scrolling gateway you'll need to use viewdata software that can be switched to terminal mode. Most Beeb and Arc packages allow you to do this. The benefits of using 80-column terminal access for Gold are numerous, as the service was designed for it in the first place.

In use, the 80-column gateway does have a couple of quirks. First, for some strange reason it locks up now and then, especially with an incoming stream of text.

The way to get around this is to press RETURN. It 'wakes up' the host, but also introduces a carriage-return into the text, which is no fun.

As far as file transfer is concerned, forget it. File transfer is useless over a seven-bit link (as Prestel is), and I haven't tried *Kermit* to see if that works yet. If anyone has, please let me know.

David Janda

NEWS IN BRIEF

● Arc users take note – a new BB dedicated to Archimedes users has opened for business. Called Arcade, it can be contacted on 081-654 2212 at a variety of speeds up to v.22bis.

The system uses Hugo Fiennes' *ARCbbs* software on a 410/1 which has been expanded to 4Mb. There are three lines connected to the system which uses WS3000 modems. Other features include 23 conference areas and 18 file areas with around 24Mb of files to download.

● A letter from a reader in Holland informs me of a useful item of PD software for the Arc. Rob Schrauwen has written an item of code called DosFS. It's a filing system that reads and writes to and from Dos/Arc discs.

Rob has entered his program into the public domain, and apparently it's doing the rounds of various BBs in the country. So, why pay for such a handy item when you can download it absolutely free!

● Another reader has written in to promote Resolve Communications BB, which is on (0582) 832653.

Duncan Webster sings the praise of said BB, and I'm sure the fact that he has an area on the board dedicated to his programs has nothing to do with it! According to Duncan the board 'is well presented and what stands out is the dedication of the sysop (John Carpenter).'

I would like to give you my own report on the board, but it's been engaged whenever I've called! However, if anyone else wishes to promote a BB they like, please write in and do so.

If you have any comms news please send it to David Janda at* BBC Acorn User*, or contact him on Telecom Gold 81:RED001 or via Prestel 919992492.



NEWS IN BRIEF

● Watt's this? It's *A Town Like Wattville*, a package which simulates electricity usage in a modern city.

It has been produced by Understanding Electricity, the educational arm of the electricity industry and is aimed at GCSE and A-level students across a variety of areas of the curriculum, including maths, science and home economics.

Among other activities, the software allows you to design a town customer by customer; supply all users with electrical power; analyse consumption patterns; and decide on charges.

A Town Like Wattville is available at £12 for both the Arc and the BBC/Master range. Understanding Electricity is at 30 Millbank, London SW1P 4RD.

● A series of booklets has been developed by South Glamorgan's Advisory Centre for Computers in Education to support teachers grappling with the National Curriculum.

They aim to help schools plan the use of IT in the curriculum by providing practical examples, avoiding jargon and technicalities. They cost £12.50 or £25 outside Wales, from the ACCE, Cefn Road, Cardiff CF4 3HS.

● Is absenteeism rising at your school? Which pupils were away last week? Who is late most often? Are these questions you want answered? If they are, Chalk Soft has a program for you.

Mark Master is a system for recording and monitoring pupil data, especially related to attendance. It uses the noughts and crosses on registers as its raw material and reveals the information hidden behind them.

The A3000 version costs £69, for the Beeb/Master it's £59. Chalk Soft can be contacted at PO Box 49, Spalding, Lincolnshire PE11 1NZ.

MAKING AN EXHIBITION



Designed to assist with science teaching at all levels, Balance Monitor runs on a Beeb and can be used in conjunction with any GEC Avery balance which has a parallel output. It will automatically monitor and collate weight readings, carry out statistical analyses and display results as graphs. GEC Avery's is at Smethwick, Warley, West Midlands B66 2LP.

The exhibition and conference season is upon us again so here's two for your diary.

The third *Micros for Special Needs* exhibition is run by Northwest Semerc at the Queen Elizabeth Hall, Oldham. It lasts from Tues, Oct 9 to Thurs, Oct 11 and will be opened by Malcolm Thornton MP, chair of the Parliamentary Select Committee on Education.

The exhibition will feature children with special needs from 11 LEAs in England and Wales demonstrating how they use computers; relevant national and regional bodies; and 50 companies selected by Northwest Semerc for the contribution their products are making to the field of special needs.

Even non-SEN specialists may find *Micros for Special Needs* interesting and informative. For further details contact Northwest Semerc, Fitton Hill CDC, Rosary Road, Oldham OL8 2QE.

The Resource conference and exhibition is really the northern equivalent of BETT. This year's accompanying conference is entitled *IT Across the National Curriculum – A Celebration*.

It will tackle issues highlighted by the implementation of the National Curriculum and the use of IT within it.

Seminars are being held on various areas including English, modern languages, humanities, technology, science, maths, music and art, plus special needs and cross-curricular issues.

Speakers will include Dave Beaumont of South Thames College on Logo beyond maths; HMI Bob Dyke on IT and SEN; Derek Allen on managing the curriculum with CASS; and NCET's Andrea Tapsfield on IT and geography.

The emphasis is on classroom experience and the supporting exhibition will be extensive.

The Resource conference takes place on November 15 at Doncaster Race Course. The delegate's fee is £12. Details are available from Trevor Millim at Resource, Exeter Road, Doncaster DN2 4PY.

HOME AND AWAY

Acorn has announced the nationwide extension of its Home and School initiative.

Headteachers in every school in the country have been sent details of the scheme and an invitation to participate.

The Home and School initiative was launched in March with the release of the Learning Curve package. It originally operated in just five LEAs.

The idea is that Acorn dealers work with schools to help parents understand the growing importance of new technology to their children's education.

Obviously the hope is that having seen how important a computer is to their child's education, parents will snap up Learning Curve bundles.

In three months, 12 specially recruited dealers have organised events at over 100 schools.

Avril Ross of MAV Ltd, a participating dealer in Berkshire, says, 'The response to the events has been extremely encouraging. Parents are keen to be involved.

'The schools have also given their full support, inviting teachers from surrounding schools and often promoting the events in the local press.'

UNIVERSAL MUSIC

The long-awaited Music 5000 Synthesiser Universal from Hybrid is now available.

A low-cost add-on, the Universal, replaces your machine's usual 'beep' with its own digitally-synthesised instruments. Sixteen sounds are on offer and up to four may be mixed together and played at once.

What's more, the Universal software is preset for 50 of the most common educational music programs and includes print options. The synthesiser works through the computer's own speaker or through any existing amplifier or music centre.

It is intended for primary classrooms but will find applications in special needs and at secondary level – in fact, wherever music is made in schools.

The Music 5000 Synthesiser Universal costs £99. Music 5000 owners only need the software for £29. (More details on the Music column on page 23.)

Lisa Hughes



WHAT? NO SOFTWARE?

The world's fastest micro may be an Einstein at maths and a Rembrandt with graphics but it's still a coda short of a full sonata when it comes to music.

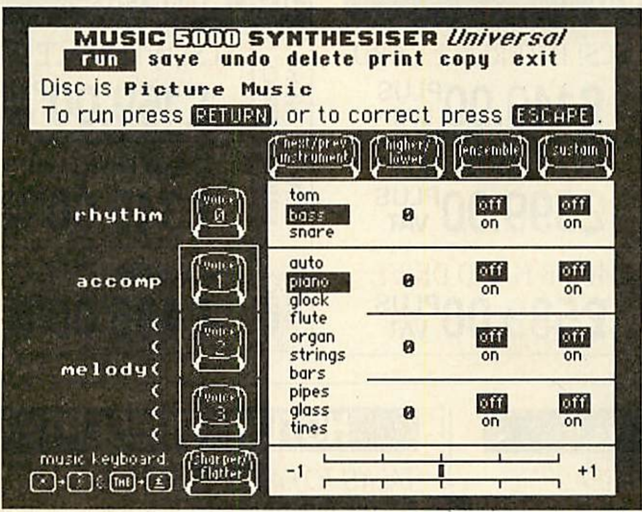
Joseph Rose of Cardiff writes to say that he is very happy with his *Studio 24 Plus v.2* but bemoans the lack of voice editing software. Come to that, there are no librarians, composition programs or MIDI drum pattern editors and, in case it had escaped anyone's notice, there is still only one Arc sequencer – from the ubiquitous EMR. Even if *!Inspiration* arrives, its proposed £459 price-tag puts it out of the reach of many users.

The Archimedes is no longer a budding babe in Acorn's arms – it has been on the market for over three years (doesn't time fly?) in which time Acorn has assiduously touted its worth as a music computer. In far less than three years the Atari ST rose to prominence as the dominant music computer. The Archimedes is potentially a far superior machine so what's going wrong? Where is all the music software?

That's easy to answer – no one (with the exception of EMR) is writing any! But why? Part of the problem is the chicken and egg situation. The ST market is still the largest for the would-be music software developer. However, Acorn is one of the few companies to have achieved a degree of brand loyalty and the number of Archimedes increases daily.

I know, too, that Acorn has always been extremely supportive of anyone wishing to write music software.

Is the Arc destined to become the musical outcast of the computer fraternity? Your thoughts and comments are welcome – particularly from music software writers!



Hybrid's Universal music system – a Master piece

MUSIC SYNTHESISER

Hybrid Technology's Music 5000 Synthesiser Universal, which was announced in this column several months ago, has now been officially released. (See a full review of this software in next month's issue)

It runs on a BBC Master and the full package consists of Music 5000 plus software which loads into sideways Ram. The software is available separately for existing Hybrid Music System owners.

The program intercepts calls to the sound chip and channels them to the Music 5000. It works with all well-written BBC music programs and is transparent to the user.

The difference it makes to the programs is amazing – it gives many a new lease of life and will be a boon in education. A start-up sequence recognises the music program being run and selects a suitable set of sounds.

It even has an entry for my book, *Making Music on the BBC Computer*. The sounds can be changed within the program even as the music is playing.

The *Spellmaster* Rom can cause the system to crash (it has been known to have a detrimental effect on other programs, too) so if your Universal ducks out, check your Roms.

More information from Hybrid Technology Ltd, 273 The Science Park, Cambridge, CB4 4WE. Tel: (0223) 420360.

EASY MENUS

This month's yellow pages contains an auto menu selection program which will be particularly useful for the disabled, although it also offers an alternative method of song selection for all Hybrid System users.

Enter the program and save it as 'jukebox'. The RUN word should contain a list of the songs on disc from which you want the user to choose. When you run the program, the cursor will automatically move down and then up the menu. To make a selection, press the SHIFT key or the fire button on a joystick.

The program will work with any Ample Menu program. Programmers can develop the joystick code to produce joystick-driven Ample programs.

EXTRA AMPLE ALBUM

The latest Ample album release from Hybrid Technology is another by budding young composer Michael Harbour. It's called *Windy Island* and shows the further development of Michael's musical style.

The album costs £4.95 from Hybrid Technology.

Ian Waugh

NEWS IN BRIEF

● Do you own an Arc running EMR's *Studio 24*? Would you like some ready-to-go arrangements to play through your system? Then check out a range of 'songs on disc' from Hands On Music Software. The discs contain arrangements in MIDI format that load into EMR's *Studio 24*. They are optimised for Roland's MT-32 expander but work with any other synthesiser.

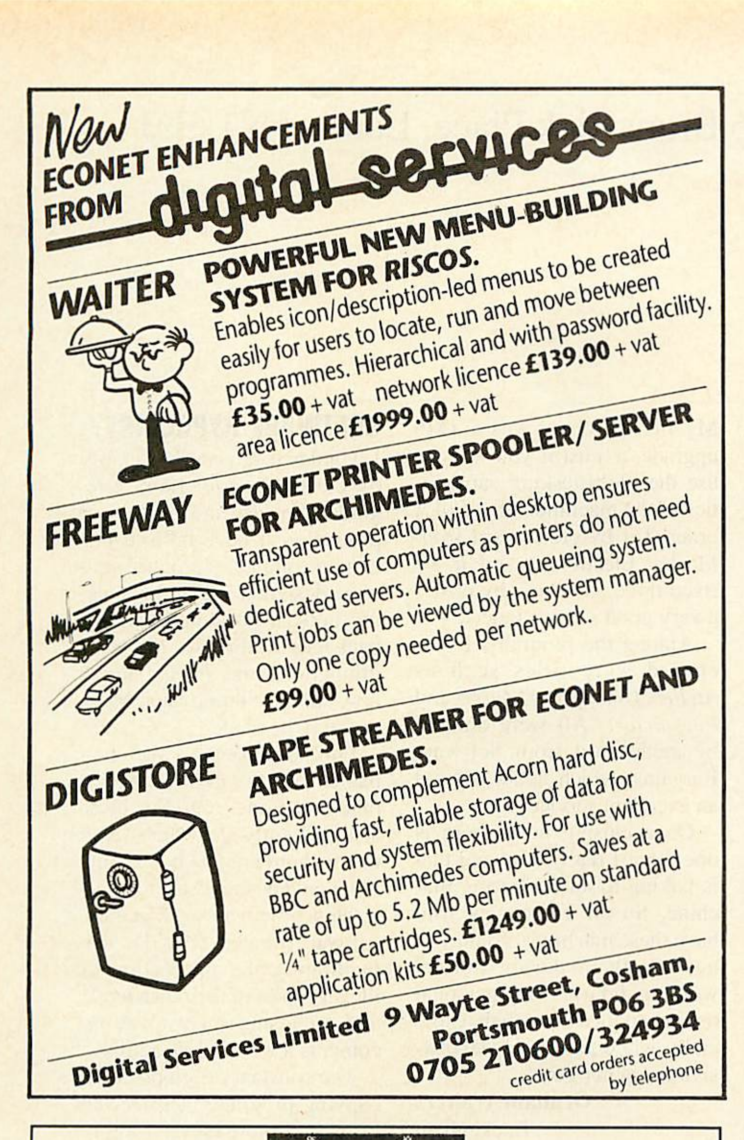
Titles include a range of Chart Hits with five songs per disc for £19.95 plus Big Band and Classical discs. Hands On Music Software is at 14 Lodge Road, Bedhampton, Havant, Hants, PO9 3LL. Tel: (0705) 452628.

● Recording Access for Music Production for the disabled (RAMP) is a charity whose aim is to bring music within reach of the disabled, mainly through computers.

Help is needed, both financially and with equipment and transport. If you think you can help, contact Roy Cramer, Paul Monaghan or Howard Davies at RAMP, 14 Challis Road, Brentford, Middlesex, TW8 9PR. Tel: 081-568 5266.

● A branch of the US-based IMA (International MIDI Association) has been set up in the UK. The IMA acts as a co-ordinating body for the development of the MIDI spec and provides a help-line service. The UK MIDI Association (UKMA) will have three levels of membership – individual (£34.50), Group (£69) and manufacturers (£138). For details contact Vic Lennard at UKMA, 26 Brunswick Park Gardens, New Southgate, London, N11 1EJ. Tel: 081-368 3667.

If you have any music news, tips or topics you'd like to see covered in this column write to Ian Waugh at* BBC Acorn User, *20-26 Brunswick Place, London, N1 6DJ.



Coming soon to BAU... **NEXT MONTH**

BACK TO SCHOOL



It's class wars again, with the kids getting back to school and parents getting used to a relatively quiet and peaceful life once again.

But how can parents become more involved in their children's education?

We offer some useful advice and examine further the needs of special education, and look at how computers can help in religious teaching. Software for maths is also summed up.

There's more in our image processing series and another foray into the depths of Arm2 programming.

Plus, we design some posters with the program of the same name from 4Mation, and if you're interested in printing in technicolour, six low-cost dot matrix printers get the full *BAU* test treatment.

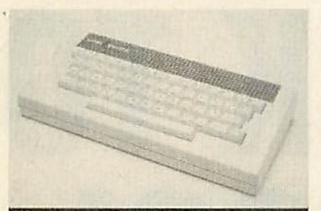
Of course, if you prefer to scan your images, then our conclusions about the latest in colour scanners should interest you.

October's issue has all this and more. Because as well as the usual mix of reviews, games, hints, tips and news, there is an added bonus.

The 24-page Business supplement will have every potential tycoon fighting at the newsstands. Full of invaluable advice on how to put your Arc to the best use at the office, the *BBC Acorn User* supplement is definitely not to be missed.

ORDER YOUR COPY NOW – IN THE SHOPS SEPTEMBER 13TH




Electron: it costs to enhance

LAST WORD

I agree with the sentiments expressed in Peter Honcap's letter in the July issue of *BBC Acorn User* that the Electron is an excellent machine that provides everything users will ever need.

However, I cannot agree with his suggestion that Archimedes owners have more money than sense.

As an enthusiastic Electron programmer, and occasional contributor to Hints and Tips, I think I have got a great deal out of the computer.

However, when I work out how much money I have spent on the Electron, by adding a Plus 1, cassette player, shadow Ram, turbo, sideways Rom board, sideways Rams, *View*, *Viewsheet* and connecting cables, all of which seemed essential to realise the machine's full capability, then I realise that my new A3000 represents good value for money six years on.

Computer users want colours, high-resolution graphics, speed of processing and impressive sound. The Archimedes has these in abundance and I, for one, am a convert.

Andrew Pillidge
Woking

SORRY...

Further to the Questions and Answers article in the July 1990 edition of *BBC Acorn User*, a misleading summary of our *Datavision* product was presented. First a price of £199 was quoted, whereas the price of the package is in fact £99. We feel this gives high performance at an affordable price.

Secondly, the article implied that the package is not available as yet. In fact it has been available as of February 1990 from Silicon Vision and all major Acorn dealers.

Finally, contrary to popular belief, *DataVision* does in fact install itself on the icon bar, coexisting with all other desktop applications that are so installed, and it does not permanently take over the machine.

Extensive facilities for transferring data to and from other Risc OS applications are provided as well.

The package can also use the full screen area for maximum data display, uncluttered high speed data access and, most importantly, secure access to datafiles which cannot be corrupted by other badly behaved applications. So we believe that the *DataVision* interface supplies the best of both worlds.

Y Nadiadi
Silicon Vision

TALKING SHOP

After having my old BBC repaired for the fourth time I thought it was time to upgrade to a new machine. So I bought an A3000 and monitor.

Unfortunately it was not from my local Acorn dealer but from a high street chain instead.

I was annoyed at the way the Acorn computers were tucked away in the back of the store.

When I asked the shop assistant why this was so, he said that there was not much of a demand for these computers and if I was going to take computing seriously I should think about buying an Amstrad or Amiga. I was not in any mood to educate the assistant so I bought the computer and left.

After playing with the machine for a while I felt it was time to look for some add-ons and some good software.


A3000: why hide it away?

My first purchase was a 1Mb upgrade, a must if you want to use the multi-tasking capabilities of the machine to the full. I ordered it by credit card from Morley Electronics and it arrived three days later by post – a very good service indeed.

Among the programs I purchased were titles such as *Atelier*, *Corruption*, *Zarch* and *Interdictor*. All were ordered by credit card from Software Bargains, which again offered an excellent service.

On a closing note, there is one thing I really hate and that is talking to an answering machine. So all companies who have these machines, could you not use them during normal working hours? The personal touch can mean so much, especially when purchasing expensive computer goods.

Graham Walters
Beckenham

PETTING YOUR ARC

I note the advice given to Mr Barnes-Cook in the June 1990 issue of *BBC Acorn User*. I still run a Commodore system as a



Will it talk to an Arc?

wordprocessor and can confirm the difficulties described. For everything else I use an Arc 310.

However, there is another aspect. As a wordprocessor, my 4032 PET and its disc drive have accumulated a great deal of correspondence files.

Perhaps the most serious problem with transferring files from *Superscript* on the PET to *First Word Plus* on the Arc is the need to translate them. I have seen no suggestion to make this possible, yet the files are Ascii and it should be a lot easier than trying to link a Commodore drive to an Acorn machine.

D A Fagandini
Dulwich

SOFTWARE HYPOCRISY?

I wonder if anyone can clarify the current state of affairs as regards some aspects of software protection. I have noticed that certain companies produce software designed solely for making personal backup copies of packages sold under the strict injunction, and indeed under law, stating that no such backups may be made.

Furthermore, the same companies who sell these ingenious machine code routines often also sell software which states that it should not be backed-up.

I would be interested to know if the people who work at these software houses consider that facilitating the production of illegal copies of their own work, and so losing themselves income, is a worthwhile activity.

The constant development of copying programs with newer, faster and more clever ways of copying other people's hard work is just as well matched by the development of newer, more devious, methods of software protection.

This copying 'war' is illogical in the best of situations, but when it occurs within the confines of a single software producer, my mind boggles.

Mrs W W Freeman
Brighton

It is strange, isn't it? We can't make sense of it either. For those who aren't aware of the situation, however, we should make it clear that copying commercial (meaning non-public domain) programs is illegal, unless the program has been purchased along with a site licence or you have permission from the producer.

Permission can also be granted in the manual by stating that you may back up the program for personal use, while the site licence also dictates that copying and use of the program must be restricted to the confines of the institution it covers. Producing copies to give to friends or indeed sell to other people thus depriving the producer of sales is against the law.



Drawing on experience

All WorraCAD drawings on this page were created on a 1Mb A3000

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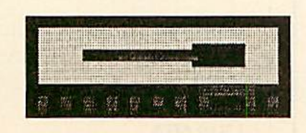
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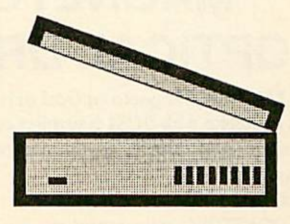
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SCSI Tape



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A selection of problems from our Post A Problem service



QUESTIONS AND ANSWERS

Q Looking back at articles and reviews in *BBC Acorn User* I see that there appear to be two desktop publishing programs for the BBC micro published by Advanced Memory Systems – *AMX PageMaker* and *Stop Press*. Are they the same and if not what are the differences between them?

A There is in fact no difference between *AMX PageMaker* and *Stop Press*. The name was changed to *Stop Press* by Advanced Memory Systems to avoid violating the copyright of US publisher Aldus. Aldus' product of the same name runs on the Apple Mac and IBM PC.

Although there have been a number of versions of *PageMaker* and *Stop Press* they are basically the same with just a few bugs fixed here and there.

The official Master 128 version is loaded into sideways Ram rather than having separate Roms fitted.

Q I have recently purchased a Casio SF8000 Digital Diary with the FA100 interface kit. I intended using this interface kit with my Archimedes when running the *PC Emulator* under it.

However, I have been having some difficulties. Could you suggest what hardware problems could be causing this?

A If your program expects CGA graphics, this emulation works well with the standard Acorn colour monitor, but any programs expecting an EGA or Hercules graphics card will be disappointed.

I wonder if your program has been written to work within the memory available under the *PC Emulator*. No program that uses extended memory above 640K will operate. Don't forget to check that you have your Archimedes correctly configured to allow the maximum of about 620K to be available.

Finally, there are a number of different versions of the *PC Emulator* around. I wonder if you have the latest, which I think is 1.33?

You can get updated versions from your dealer or direct from Acorn. If you do the latter, have it sent recorded delivery.

Q I know that with a BBC Master 128 you can alter the configuration of the RS232 port. Can you expand on what the possible configurations are and how you achieve them?

Also is it possible to configure non-standard RS-232 formats?

A It is very easy to configure the RS232 port on the Master 128. You have to use the *CONFIGURE DATA <n> command. With this you can specify the data format used by the RS232 interface according to the specified value of n.

The acceptable configurations are:

Value	Word	Parity	Stop
0	7	even	2
1	7	odd	2
2	7	even	1
3	7	odd	1
4	8	none	2
5	8	none	1
6	8	even	1
7	8	odd	1

It is possible to implement non-standard RS232 formats with the Master 128.

This is achieved by using the OSBYTE call. OSBYTE 156 (&9C) (Read/write serial ACIA control register and copy).

This call is used if it is necessary to program the ACIA directly, such as when implementing non-standard RS232 formats, as detailed in Part 1 of the Master Reference Manual on pages D.2-47 and 48.

Q I've just got myself a bargain, as someone moving on from their Archimedes A310M sold it to me at a bargain price. Unfortunately it still has the Arthur operating system. Can this be upgraded and if so how? I'm also having problems with the serial port. I heard from a friend that it needs a fix.

A You ought to upgrade to Risc OS as soon as possible. You can fit the four chips yourself and they can be obtained from dealers like Norwich Computer Centre, 18 Mile End Road, Norwich, NR4 7QY for about £35.

In early versions of the Archimedes, there were problems with serial devices. But the serial port now works fine under Risc OS.

Q I have recently purchased a secondhand BBC micro for our school. It has an issue 4 board which has been upgraded in various ways. When I switch it on it does not give the usual BBC Computer Acorn DFS message. Instead the message refers to a Watford

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double density DFS being installed. Will this cause us problems with running educational software?

A The Watford Electronics *DDFS* disc filing system you have can be described as being broadly compatible with the Acorn DFS. It does have some different, extra features, which should be explained in the manual. If you were not supplied with one, Watford Electronics should help.

Q Can you tell me what the pin-outs mean on the Archimedes' serial port?

A The serial port on the Archimedes and BBC A3000 uses a nine-way D-type plug. The pin-out is as follows:

Pin	Acorn name	Meaning
1	DCD	Data Carrier Detect
2	RxD	Receive Data
3	TxD	Transmitted Data
4	DTR	Data Terminal Ready
5	Ov	Common Return, Signal Ground
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear to send
9	RI	Ring Indicator

Pin one is top left and pin nine is bottom right looking into the back of the Arc.

Q I am having disc drive operation problems. When loading games from disc I never have trouble. When loading and saving text with *Wordwise Plus* everything is alright too.

But when I am using the *Viewstore* database package I keep getting disc errors. What is the cause of this?

A Your letter seems to indicate that the problems you are experiencing only occur when using programs that read and write to and from the disc over an extended period.

For instance, database packages like *Viewstore* access the disc for quite long periods when reading records into the computer's memory and if, for instance, the heads of the disc drive are out of alignment or the disc drive heads are worn a CRC error will be given.

With normal program loading, say when loading a simple game or saving text with a wordprocessor, the alignment or quality of the head's condition will not be as crucial and so no CRC error will occur.

You should take your drive for servicing. Ask the dealer to check alignment and head wear.

But before you do this I suggest you do try experimenting with the Disc Access Timings which control things like step time, settlement time, and head load time. These can be altered by software using various *FX commands. The commands are:

```
*FX255,0,207
*FX255,0,223
*FX255,0,239
*FX255,0,255
```

Remember they do not take effect until after a soft break and remain until a hard break.

Q I am having problems getting the underline command in *Wordwise Plus* to print correctly using the Taxan/Kaga printer. Can you help me?

A First you ought to check that you are entering the US and/or UE commands correctly with the f1 and f2 keys.

The special embedded commands like US, UE, DS, and DE are set within *Wordwise Plus* to be compatible with the Epson MX and FX series of printers. The Canon you have is highly compatible and its only real difference is the near letter quality font which uses a different escape sequence to that of 'true' Epson printers.

So there is no reason why you should experience any problem with the Taxan/Kaga printer, but it will depend on you having the printer's internal Dip switches set correctly.

In order that you can check your Dip switches I list below the setting on our Taxan/Kaga:

```
Power Supply to this side
1 ON 1 OFF  1 ON  2 OFF 2
OFF  2 ON 3 OFF 3 OFF 3
OFF 4 ON 4 OFF 4 OFF 5 OFF
5 ON  6 OFF 6 OFF 7 OFF 7
ON 8 OFF 8  OFF
```

ACORN CUSTOMER HOTLINE

Registration forms are supplied with all Acorn's computers, peripherals and the majority of software packages for the Archimedes or BBC A3000 series. Please remember to fill in and return the registration forms. Doing this, you register your computer for warranty , so if your computer fails, a speedy repair can be done.

● Acorn has released another Font pack for use with the Risc OS Font Starter Pack, Acorn *Desktop Publisher* or any third party application which uses the Acorn *Outline Font Manager*. Called the *Symbol Font Pack* it contains a completed Symbol (ZapfDingbats) font and the Sidney (Symbol) font. The *Symbol Font Pack* costs £51.75 and its stock code is SKF03.

● Acorn has developed a Risc OS application, *!Teletext* that allows Teletext adapters on Econet networks to be accessed from Acorn Archimedes and BBC A3000 systems. *!Teletext* runs within the Risc OS desktop environment, displaying full teletext pages in a window. *!Teletext* can be obtained from the schools closed user group area on SID (Acorn's Support Information Database).

Users of SID who wish to access the Schools Information Service should write on headed school paper quoting your Sid ID to the SID Editor, at our Fulbourn Road address.

● *First Word Plus* Release 2 is supplied with a !Run file that will take whatever free memory is available in the Next slot of the Task Manager. When you switch your Archimedes or BBC A3000 on the Task Manager sets the Next slot to 640K which on a 1Mb system is almost all the available memory. It is however possible to change the !Run file of *1st Word Plus* to take only a set maximum amount of memory. This can be achieved by loading the !Run file in *!Edit* and then scrolling to the bottom of the file where you will find the command:

```
WimpSlot -min 416k
```

Change the command to read:

```
WimpSlot -min 416k -max xxxk
```

The parameter xxxk can be any value over the minimum requirement for *First Word Plus* to start, which is 416k, so the command could look as follows:

```
WimpSlot -min 416k -max 564k
```

The file can then be resaved back into the *First Word Plus* directory. Ensure you have backup copies of the software.

● A number of people have problems attempting to print the text they create in *!Edit*. To print text you must first ensure the correct printer driver is loaded. Then bring up the save text dialogue box within *!Edit* then, instead of dragging the file to a filer window, drag the file over the printer driver icon on the icon bar. The printer driver will understand that it is pure text and will print it as such. If you have a text file on disc which you wish to print, then simply drag it from the filer window over the printer driver icon.

● Archimedes and BBC A3000 software which works outside the desktop will quite often reconfigure the computer, unplugging various modules and resetting various CMOS Ram settings. If it does not, set the computer back to its original state, then error messages such as SWI &xxxxxxx not known will occur. There are two types of reset which will return the computer back to a state where it is usable. The first is an R Power On, which simply involves holding down the R key while switching on the computer. This will reset the machine except for the number of floppy drives, the number of hard drives, the country setting, Econet station number and the bytes of CMOS relating to the expansion cards. The other reset is a Delete power on. This resets the whole machine except for the Econet station number.

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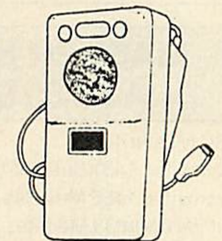
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1Mb + 40Mb HD (Toshiba)	**£355(a)**
3Mb + 20Mb HD	**£389(a)**
3Mb + 40Mb HD (Toshiba)	**£479(a)**
3Mb + 50Mb HD	**£529(a)**

All the above upgrade packs come complete with cables, brackets and fitting instructions. Hard drives are ready formatted.

TRACKER BALL

A sturdy, high quality tracker ball is now available to replace the Archimedes mouse. You will no longer run off your mouse mat and at the same time you can save the valuable desk space. The tracker ball is fully compatible with the Arc mouse driver. **£47(c)**



HARD DRIVES & CONTROLLERS

Acorn 20Mb HD + Controller (310)	**£379(a)**
A3000 HD Controller and 20Mb drive	**£389(a)**
A3000 HD Controller and 40Mb drive	**£509(a)**

Both units separately cased with external PSU for the drive.

Techno HD Controller for 2 HD (310)*	**£149(b)**
SCSI HD Controller	**£299(a)**

Internal ST506 drives for 410 supplied complete with mounting bracket, cables & instructions

Techno 20Mb 40 ms	**£179(a)**
40Mb 25 ms Autoparking	**£329(a)**

Auto parking for ease of use.

Techno 50Mb 28 ms	**£369(a)**

External ST506 HD as 2nd HD

20Mb (cased & psu, cables)	**£249(a)**
40Mb (cased & psu, cables)	**£379(a)**
50Mb (cased & psu, cables)	**£449(a)**
External HD adaptor plate (300/400)	**£30(c)**

A3000 4MB RAM CAPABILITY

The TechnoRAM Card for the A3000 with either 1MB or 3MB on board, allows you to expand up to 2 or 4MB. 1MB version upgradeable by us to 3MB. Totally compatible with Econet upgrades.

1MB technoRAM £79(c) **3MB technoRAM £209(c)**

ARCHIMEDES MONITORS

Microvitec CUB 3000 14" RGB
Med Res, specially designed for ARC **£199(a)**
Dust Cover for CUB 3000 **£5.50(d)**

Philips CM8833 14" RGB Med Res.
TTL/Linear Mono/Colour, Stereo sound. **£239(a)**

Acorn Philips 14"
Colour Monitor **£220(a)**

TAXAN 775
MultiSysnc 14" colour, ideal for Archimedes hi res modes. Our price includes tilt and swivel stand. **£429(a)**

VIKING II 19" Hi Res.
White screen for CAD applications with tilt & swivel stand. **£849(a)**

A3000 EXPANSION

AEDA external floppy drive adaptor	**£30(c)**
Wild Vision Chroma 220	**£155(b)**
Wild Vision Chroma 235	**£199(b)**
Wild Vision Chroma 250	**£355(b)**
Acorn MIDI/User port	**£49(b)**
Chromatext	**£39(c)**
XAT Video Utilities Package	**£79(c)**
MultiPod	**£145(b)**
technoSCAN	**£175(a)**
Tracker Ball	**£47(c)**
technoTABLET (needs serial kit)	**£249(a)**
Stylus	**£25(d)**
Serial upgrade kit	**£19(c)**

300/400 SERIES EXPANSION

Technolog backplane (4 slots)	**£23(c)**
Fan for Technolog backplane	**£8(d)**
I/O expansion card	**£80(b)**
MIDI add-on to I/O card	**£37(c)**
MIDI Expansion card	**£66(c)**
CC Rom expansion card	**£45(c)**
ACORN ROM expansion card	**£51(c)**
MultiPod	**£117(b)**
16 bit Parallel I/O card	**£195(b)**
ADC1208 A to D converter	**£695(b)**
Dual RS232 Serial card	**£195(b)**
IEEE Interface card	**£283(b)**
Tracker Ball	**£47(c)**
technoTABLET	**£249(a)**
Stylus	**£25(d)**
ARC Prototyping board	**£35(c)**
Wild Vision Chroma 320	**£155(b)**
Wild Vision Chroma 335	**£295(b)**
Wild Vision Chroma 345	**£395(b)**
Wild Vision Chroma 400	**P.O.A.**
Chromatext	**£39(c)**
XAT Video Utilities Package	**£79(c)**

technoSCSI PACKAGES

High quality SCSI drives with ACORN's SCSI controller card.

105 Mb Internal	**£899(a)**
330 Mb External	**£1999(a)**
105Mb External	**£999(a)**

Phone for free data sheet

External drives are suitable for 300, 400 series and A3000

MULTIPOD PROFESSIONAL

Professional design and use of latest hardware/software technology have enabled this five function podule to provide the highest quality performance at economical and realistic price. The five functions are fast-scan video digitiser, sound digitiser, serial port, instrumentation/joystick port and 3 BBC compatible ROM sockets.

MULTIPOD PROFESSIONAL	**£117(b)**
MULTIPOD PROFESSIONAL FOR THE A3000	**£145(b)**
FILTER SET FOR VIDEO CAMERA (RGB)	**£15(d)**

TEL: 081-205 9558

For fast delivery telephone your order on 081-205 9558 using VISA/Access Card





Orders welcome from government depts & educational establishments

TECHNOMATIC

Techno House 468 Church Lane, London NW9 8UF.
Tel: 081-205 9558 Fax: 081-205 0190
Mon-Fri: 9.15-5.30. Sat: 10.30-4.00

Printer Hotline 081-205-9558 Ring for the best prices

PRINTERS & PLOTTERS

EPSON

Epson LX/FX
Epson's budget priced 9 pin printers offer quality and reliability with Epson's advanced paper handling technology, draft and NLQ print in variety of typestyles and fonts:

LX400 180cps draft 30cps NLQ	£135(a)
LX850 200cps superdraft 30cps NLQ	£209(a)
FX850 264cps draft 54cps NLQ	£319(a)
FX1050 as FX850 but wide carriage (132 col)	£409(a)

Epson LQ range
Epson's 24 pin printers with superior draft and letter quality, variety of typestyles and fonts, high res graphics, advanced paper handling and Epson's reliability:

LQ400 180cps draft 60cps LQ	£209(a)
LQ550 180cps draft 60cps LQ	£279(a)
LQ850 264cps draft 88cps LQ	£465(a)
LQ1050 as LQ850 but wide carriage (132 col)	£575(a)

Epson Colour Printers
High speed 9 and 24 pin printers with colour option fitted:

EX800 300cps draft 60cps NLQ	£429(a)
EX1000 as EX800 but wide carriage (132 col)	£549(a)
LQ860 as LQ850 but with colour	£529(a)
LQ1060 Wide carriage version of LQ860	£649(a)
LQ2550 400cps draft 133cps LQ	£780(a)

Epson Inkjet/Laser Printers

SQ850 600cps draft 198cps LQ	£569(a)
SQ2550 as SQ850 but wide carriage (132 col)	£699(a)
GQ5000* Laser 6ppm multifont	£895(a)*

(Free 12 months on site maintenance included in the price)

DFX5000 9pin Hi Speed Line printer 533cps	£699(a)

NATIONAL PANASONIC

KXP1081 + Master Printer Lead	£125(a)
KXP1124 24 pin 190cps draft 60cps LQ complete with 38K buffer	£229(a)

STAR

LC10 9 pin 144cps draft 86 cps NLQ	£139(a)
LC15 as LC10 but wide carriage (132 col)	£289(a)
LC10 Colour version of LC10	£179(a)
LC24-10 24 pin 180cps draft 60cps NLQ	£209(a)
LC24-15 Wide carriage version of LC24-10	£349(a)
NB24-10	£409(a)

CANNON

Bubble jet 130E	£499(a)

INTEGREX

132 Inkjet Colour Printer	£559(a)

HEWLETT PACKARD

Laserjet Series IIP	£749(a)*
Laserjet Series IID	£1859(a)*
Laserjet Series III	£1249(a)*
Deskjet Plus	£509(a)*
Deskjet	£449(a)*
Paintjet	£709(a)*

*FREE 12 months on site maintenance contract included

JetRAM Laserjet Upgrades

1Mb	£149(a)	2Mb	£249(b)
3Mb	£339(a)	4Mb	£439(b)

PLOTTERS

ROLAND A3 8 pen FLATBED PLOTTERS

DXY1100	£549(a)
DXY1300	£899(a)
DXY1200	£719(a)

Phone for details of A0, A1 and A2 sizes

PRINTER ACCESSORIES

Serial Interfaces

Epson 8143	£32(d)
Nat Pan KXP17	£39(d)
Epson8148(8Kbuffer)	£79(d)

Buffers

32K Buffer IC for P1124/1540	£18(d)

Cut Sheet Feeders:

LX400/800/850, LQ400/550	£69(b)
FX800/850, LQ800/850	£135(a)
LC10	£55(b)
LC24-10	£89(b)
Brother HR20	£209(a)
KXP1124	£88(b)
KXP1540	£179(a)

Full Tractor Feeds:

LQ800	£49(b)
LQ1000	£55(b)
LQ850	£70(b)
LQ1050	£85(b)

PRINTER STAND

A new style printer stand with easy paper feed and paper seperation, provides complete access to paper. Can be used with both top and bottom paper feed. Very space efficient. **£22(b)**

MODEMS*

MIRACOM WS4000 V21/V23	£129(b)
MIRACOM WS3000 V22	£249(b)
MIRACOM WS3000 V22bis	£395(b)
PACE LINNET V21/23	£135(b)

**All models carry a BABT Approval*

3M FLOPPY DISCS

5.25" Discs in packs of 10

744 40T SSDD	£5(d)
745 40T DSDD	£5(d)
747 80T DSDD	£7(d)
3.5" DSDD Discs	£7.50(d)

STORAGE BOXES

Library Cases:

10 × 5.25"	£1(d)
10 × 3.5"	£1(d)

Lockable Boxes;

3.5": 40 Discs	£6(c)
3.5": 80 Discs	£7(c)
5.25": 50 Discs	£6(c)
5.25": 70 Discs	£7(c)
5.25": 100 Discs	£8(c)

CONSUMABLES

Guaranteed High Quality Ribbons

Epson:

LX80/86/800,400/850	£3.50(d)
MX/RX/FX80/85/800/850	£3.50(d)
MX/RX/FX100, FX105/1000/1050	£5(d)
LQ400/550/800/850	£4.50(d)
LQ1000/1050, EX800/1000 (Black)	£7(d)
EX800/EX1000 Colour	£15(d)

Star:

LC10/NL10	£3.50(d)
LC10 Col	£5(d)
LC10 Colour	£6.50(d)
LC24-10	£5.00(d)

National Panasonic

KXP1081	£3.50(d)
KP1124	£6(d)
Taxan KP810/815/910/915	£5.00(d)
Juki 6100	£1.80(d)
Integrex Black Cartridge	£10.50(d)
Integrex Colour Cartridge	£16(d)

Plotter Pens:

Roland 4 pen set. (water/oil) (various sizes)	£7.50(d)
EX800/EX1000 Colour Kit	£15(c)

Paper & Labels
Plain fanfold *woodfree* paper with microperforations:

2000 sheets: 9.5" x 11" 60gsm	£13(b)
1000 sheets: 9.5" x 11" 60gsm	£7(c)
1000 sheets: A4 80gsm	£13(b)
1000 sheets: A4 90gsm	£14(b)
500 Loose A4 sheets	£4(c)
50 sheets Art paper 115gsm A4	£3(c)
50 sheets Art paper 115gsm A3	£5(c)
Integrex Paper Roll Std:	£9(d)
Integrex Paper Roll High Quality:	£18(d)

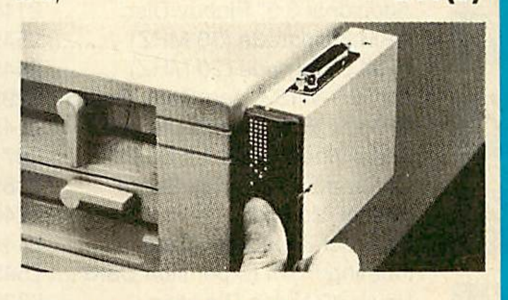
Labels/1000

Single Row 3½ x 1 7/16"	£6.75(d)
Double Row 3½ x 1 7/16"	£6.75(d)

BUFFERS & SHARERS

Smart Printer Buffer 256K
256K parallel buffer with facilities for 256 copies, PAUSE, RESET & SELF-TEST **£149(b)**

Compact Two Way Switch
An economical solution for connecting two computers to one Printer or one computer to two printers. Easily attaches to the side of computer or monitor (specify parallel or serial) **£19(c)**



Manual Printer Sharers:
(All lines are switched).

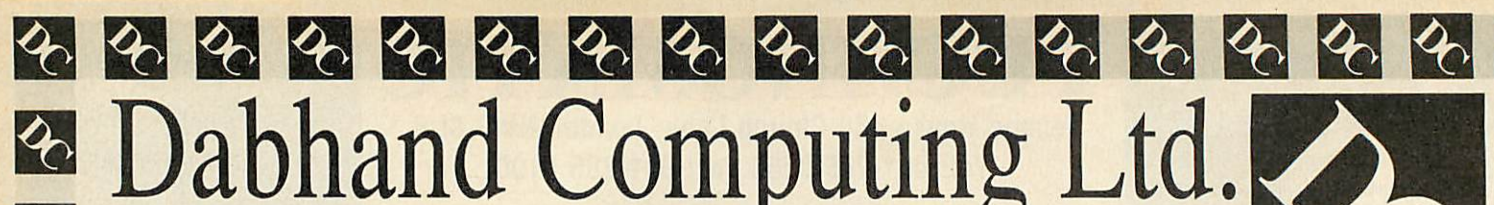
	Parallel	Serial
2 computers to one printer	£23(c)	£23(c)
3 computers to one printer	£30(c)	£30(c)
4 computers to one printer	£36(c)	£36(c)
2 computers to 1 or 2 printers	£49(c)	£49(c)

Cable sets for above sharers available for all popular computers

Parallel Printer Leads

BBC/Master (1.2m)	£5(d)
BBC/Master (2m)	£7(d)
Archimedes (2m)	£7(d)
Compact (1.2m)	£7(d)
Nimbus 2m	£7(d)
36/36way centronics (2m)	£9(d)
IBM/PC Compatible (2m)	£7(d)

TEL: 081 205 9558



Dabhand Computing Ltd.



TERMS: UK residents add 15% VAT to all prices, except books. Delivery FREE on all postal items in the UK. Export, no VAT, carriage at cost. (quotations available). Europe maximum £2.50 software, £35 hardware. Access/Visa cards accepted by post/phone/in person. We are authorised Acorn dealers. Official orders accepted from public sector/education/PLCs, otherwise cash with order. Tender invitations welcome. Callers welcome. We are about 800 yds north of J17, M62. Fax: 061-766 8425. Price subject to change without notification. Goods offered subject to being unsold.

Dabhand Computing Ltd; 5 Victoria Lane, Whitefield, Manchester M25 6AL. This advert was produced using Impression from Computer Concepts.

Archimedes Computers

A 3000	**£599**
A 3000 Learning Curve *	**£699**
A 410/1	**£1099**
A 420/1	**£1499**
A 440/1	**£1699**

We can match or improve on prices advertised or quoted in or from this magazine please phone for the best deals.

We operate the Acorn Schools, University and the new teachers personal purchase schemes.

* Pack includes PC Emulator, 1st Word Plus, Genesis, Learning Curve Video and literature.

Oak SCSI Devices

20 Mb Internal Hard Disc	£345
45 Mb Internal Hard Disc	£449
80 Mb Internal Hard Disc	£695
100 Mb Internal Hard Disc	£995
200 Mb Internal Hard Disc	£1260
20 Mb External Hard Disc	£485
45 Mb External Hard Disc	£565
80 Mb External Hard Disc	£825
100 Mb External Hard Disc	£1085
200 Mb External Hard Disc	£1425
300 Mb External Hard Disc	£2199
512 Mb External Hard Disc	£2865
560 Mb Magneto Optical Drive	£3475
42 Mb Ext. Removable Hard Disc	£999
60 Mb Tape Streamer	£860
Tape for above	£22
150 Mb Tape Streamer	£1249
Tape for above	£25
1 Gb Tape Drive	£3299
Tape for above	£30
for additional devices deduct	£100

Archimedes A400

5.25" Ext. floppy disc interface	£30
Additional 3.5" Floppy Disc	£119
ARM 3 Upgrade (30 MHZ)	£545
ARM 3 Upgrade (20 MHZ)	£445
ArVis S-VHS Video Cont. Board	£295
ArVis S-VHS Encoder Board	£145
ArVis Video Graphics Board	£877
Chroma 345 Overlay Board	£389
Econet Module	£46
Ethernet Expansion Card	£449
Floating Point Expansion Card	£549
Hawk V9 Video Digitiser	£339
I/O Expansion Card	£79
Midi Upgrade to I/O Exp. Card	£27
Midi Expansion Card	£65
Midi Upgrade Rom	£14
Rom Expansion Card (CC)	£45
Rom Exp. Card with Battery (CC)	£65
Scanlight Junior Scanner (CC)	£179
Scanlight Senior Scanner (CC)	£389
Sheet Feeder for above (CC)	£95
SCSI Expansion Card (Acorn)	£299
VIDC Enhancer	£29

Dabhand 400 Series Expansion Options

Dabhand 410/1 to 420/1

Acorn A410/1 upgraded to A420/1 specification using only the highest quality Samsung Ram and Oak's "Zero Defect" 20 Mb Seagate ST 125-1 28ms drive formatted and tested for guaranteed trouble free use.

A410/2 20 Mb	**£1099**
Colour System	**£1289**
Eizo 9060 SZ System	**£1558**

Dabhand 410/1 to 440/1

Acorn A410/1 upgraded to A440/1 specification using Oak's 47 Mb Rodime 28ms drive formatted and tested as above.

A440/1 specification	**£1349**
Colour System	**£1538**
Eizo 9060 SZ System	**£1808**

Oak 410/1 ST506 Hard Disc Drives

Archimedes A410 Internal Hard Disc Drives for use with 'on-board' ST506 winchester controller. Comes complete with mounting chassis, screws, connecting cables and easy to follow fitting instructions.

20 Mb 28ms	**£169**
40 Mb 28ms	**£285**
47 Mb 24ms	**£345**

A400 Series Ram Upgrades

Fast Samsung Ram complete with step by step fitting instructions.

1 Mb Ram	**£65**
2 Mb Ram	**£120**
3 Mb Ram	**£175**

A410/1 Series Ram and Oak Drive Upgrades

Up to 2 Mb Ram + 20 Mb	**£229**
Up to 2 Mb Ram + 40 Mb	**£349**
Up to 2 Mb Ram + 47 Mb	**£409**
Up to 4 Mb Ram + 20 Mb	**£339**
Up to 4 Mb Ram + 40 Mb	**£459**
Up to 4 Mb Ram + 47 Mb	**£519**

Dabhand Art/CDT Pack

Acorn A410/1 upgraded to A420/1 specification complete with:-

Atelier or Pro Artisan
WorraCAD
RISC OS Extras & Utils Discs
Box of discs, printer cable and mouse mat

A410/2 Art/CDT Pack	**£1219**
Colour System	**£1408**
Eizo 9060 SZ System	**£1678**

Dabhand DTP Pack

Acorn A410/1 upgraded to A420/1 specification complete with:-

Impression & Scanlight Junior
Atelier or Pro Artisan
RISC OS Extras & Utils Discs
Font FX, Box of discs, printer cable and mouse mat

A410/2 DTP Pack	**£1439**
Colour System	**£1628**
Eizo 9060 SZ System	**£1898**

Dabhand Business Pack

Acorn A410/1 upgraded to A420/1 specification complete with:-

Impression & Scanlight Junior
Pipedream
RISC OS Extras & Utils Discs
Font FX, Box of discs, printer cable and mouse mat

A410/2 DTP Pack	**£1469**
Colour System	**£1658**
Eizo 9060 SZ System	**£1928**

Additional upgrades for Dabhand Packs

Up to 4 Mb Ram	**£120**
Up to 40 Mb Hard Disc	**£116**
Up to 47 Mb Hard Disc	**£176**
Up to 4 Mb Ram + 40 Mb	**£236**
Up to 4 Mb Ram + 47 Mb	**£296**

Please add these prices to the base system prices quoted above.

Floppy Disc Drives

5.25" Single 40/80 no psu	£95
5.25" Single 40/80 with psu	£109
5.25" Dual 40/80 no psu	£185
5.25" Dual 40/80 with psu	£199
3.5" Single with psu	£85
3.5" + 5.25" 40/80 no psu	£185
3.5" + 5.25" 40/80 with psu	£209

Monitors

Acorn badged Colour	**£199**
EIZO 9060SZ Multisync	**£465**
Philips CM8833	**£225**
Taxan 775 Multisync	**£425**

All monitors come with free lead. State type of computer when ordering.

Dabhand A3000 Series Expansion Options

A3000 Art/CDT Pack

Acorn A3000 upgraded to 2 Mb of memory complete with:-

Atelier or Pro Artisan
WorraCAD or KiddiCAD
Oak monitor stand and expansion bridge
Acorn Colour Monitor
RISC OS Extras & Utils Discs
Box of discs, printer cable and mouse mat

A3000/2 Art/CDT Pack £999

A3000 DTP Pack

Acorn A3000 upgraded to 2 Mb of memory complete with:-

Atelier or Pro Artisan
Impression & Scanlight Junior
Oak monitor stand and expansion bridge
Acorn Colour Monitor
RISC OS Extras & Utils Discs
Box of discs, printer cable, Font FX and mouse mat

A3000/2 DTP Pack £1299

Oak A3000 Expansion System

Monitor Stand	£21
System Housing	£35
18 Watt PSU (Floppy Disc Drives)	£30
55 Watt PSU (Hard Disc Drive)	£79
90 Watt PSU (Hard Disc & Tape)	£89
Fan Kit	£15
3.5" Floppy Kit	£94
5.25" Floppy Kit	£84
20 Mb SCSI + Controller	£385
45 Mb SCSI + Controller	£505
80 Mb SCSI + Controller	£805
100 Mb SCSI + Controller	£1124
200 Mb SCSI + Controller	£1468

Ring for details of full range including Tape Drives, Removable Hard Discs.

A3000 SCSI Devices

20 Mb External Hard Disc	£485
45 Mb External Hard Disc	£565
80 Mb External Hard Disc	£825
100 Mb External Hard Disc	£1085
200 Mb External Hard Disc	£1425
300 Mb External Hard Disc	£2199
512 Mb External Hard Disc	£2865
560 Mb Magneto Optical Drive	£3475
42 Mb Ext. Removable Hard Disc	£999
60 Mb Tape Streamer	£860
Tape for above	£22
150 Mb Tape Streamer	£1249
Tape for above	£25
1 Gb Tape Drive	£3299
Tape for above	£30

A3000 Upgrades

User & Midi Podule	£46
Serial Upgrade	£19
Monitor Stand (Acorn)	£29
Monitor Stand (Pres)	£24
5.25" External floppy disc cable	£15
5.25" External floppy disc buffer (Pres)	£46
Serial Link Kit (BBC-Arc)	£14
Dust cover (Keyboard + Monitor)	£12

Printers

Citizen 120D+ (Serial add £20)	£129
Citizen Swift 9	£195
Star LC10	£139
Star LC10 Colour	£179
Canon Bubblejet BJ-130E	£539
Citizen Swift 24	£259
Colour Kit for above (also Swift 9)	£39
Sheet Feeder for Swift Range	£89
Star LC24-10	£209
Integrex Colourjet 132	£519
HP Paintjet	£795
LASER DIRECT (CC)	£899
HP Laserjet IIP Printer	£795
Additional 1Mb RAM for IIP	£179

Master Series

Master 128	**£369**
Master Colour Monitor	£189
Eprom Cartridge	£10
Master Dust Covers	£6

Books (No Vat)

C: A Dabhand Guide	£14.95
Archimedes Assembly Language	£14.95
Archimedes Operating System	£14.95

The above books have accompanying discs add £5 for 5.25", £7 for 3.5"

Archimedes First Steps	£9.95
BASIC V: A Dabhand Guide	£9.95
RISCOS PRM's	£79.95
NEW Acorn DTP Advanced U.G.	£14.95
BBC Basic Guide (Acorn)	£19.95
Master 128 Ref. Man.Pts 1&2 .. (ea.)	£14.95
New Advanced User Guide	£19.95

Additional Arc Software Manuals (Acornsoft)

First Word Plus, DTP, Assembler . (ea.)	£10
ANSI C Version 3	£29

A3000 Ram Upgrade

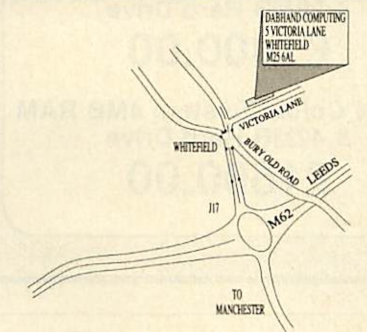
1 Mb upgrade using high quality Ram

1 Mb Ram Upgrade £79

Software

Acorn Desktop Publisher	£109.95
ANSI C V.3 Compiler + free C Front	£139.95
Apocolypse (3D Space Game)	£24.95
Arc DFS (DFS Filing System)	£26.04
Arcade Soccer	£14.95
ArcComm (BBC Soft)	£24.95
Armadeus (Sound Sampler)	£69.95
Armadeus (Sampler Board)	£139.00
Artisan 2 (16 Colours)	£49.95
Atelier (Minerva 256 Colours)	£79.95
Battle Tank (Minerva)	£12.95
Casino (Minerva Desktop Games)	£14.95
Caverns (Minerva Arcade Game)	£17.35
C-Front (Mitre Front End for ANSI C)	£17.35
Clip Art for Draw/Impress. (Midnight Graphics)	£29.95
Colour Printer Sprite Dumps (Midnight Graphics)	£26.04
Disc Tree 2 (Mitre Hard Disc Utility)	£39.95
Euclid 2 (3D Drawing)	£57.95
E-Type (Driving Simulation)	£14.95
E-Type 100 Miles / Designer ea.	£14.95
Family Favorites (Minerva Compilation)	£14.95
First Word Plus V2 (Acorn)	£79.95
Fireball 2 (Superb breakout clone)	£24.95
FONT FX (Effects for Draw/Impression)	£8.65
Fugitives Quest (Robico Adventure)	£23.95
Genesis (Hypermedia System)	£79.95
GRAPHBOX with Hotlink to PDream 3	£69.95
HEREWITH THE CLUES (Murder Adv)	£22.95
Holed Out (Golf Game)	£14.95
Holed Out Extra Courses , Designer	£12.95
HOSTAGES (Superior)	£14.95
Ibix the Viking (Arcade Adventure)	£15.95
Impression (Document Processor)	£139.00
Interdictor (Flight Simulator)	£24.95
MAN AT ARMS (4th Dimension)	£14.95
Mini Hyperpacks (3 games per pack)	£19.95
Hyperpack (12 Games)	£79.95
Maddingly Hall (Minerva Adv.)	£12.95
MANCHESTER UNITED	£22.95
Multistore Database (Minerva)	£199.00
Olympics (6 events) 4th Dimension	£17.35
PC Emulator + free PCE Sh/ware 1&2	£99.00
Pipedream 3 (WP)	£129.00
PIPE MANIA (Addiction beyond belief)	£17.35
ProArtisan (256 Colours)	£79.95
REDSHIFT (Minerva scrolling arcade)	£14.95
Render Bender (Clares)	£59.95
Render Bender Demo Discs (Clares)	£10.00
Render Bender Demo Discs (Dabhand)	£10.00
Rotor (Arcade Strategy Game)	£19.95
Stranded (Robico Adventure)	£23.95
SUPERIOR GOLF	£14.95
System Delta Plus (Minerva)	£69.00
Talisman (Minerva Graphical Adv.)	£12.95
The Guild of Thieves (Mag.Scrolls Adv.)	£26.04
The Pawn (Magnetic Scrolls Adventure)	£26.04
Thundermonk (Arcade Adventure)	£14.95
Trivial Pursuit (Board game)	£24.95
U.I.M. (Submarine Battle)	£24.95
Worra Battle (Oak Tank Battle)	£14.95
Worra Plot (Draw/HPGL Plotter Driver)	£24.95
World Class Leader Board (U.S. Gold)	£19.95

How to find us

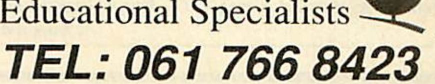


Hours of Opening
Monday - Friday 9.00 a.m. - 5.00 p.m.
Saturday 10.00 a.m. - 5.00 p.m.

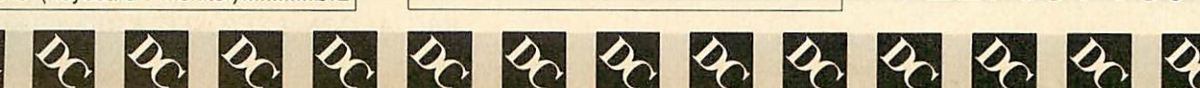
NO Carriage Charges in Mainland UK

Acorn Qualified Dealer
Educational Specialists





TEL: 061 766 8423



Watford Electronics

Jessa House, 250 Lower High Street, Watford WD1 2AN, England
Tel: Watford (0923) 37774   Tlx: 8956095   Fax: (0923) 33642

Acorn — The choice of Experience

Shop Hours: 9am to 6pm (Mon.-Sat.) Thursday 9am to 8pm. FREE customer car park.
All prices exclusive of VAT; subject to change without notice & available on request.
Credit Card Orders (ACCESS & VISA) Tel (0923) 33383 or 50234 (24 Hours)

The choice before and after the experience

Archimedes micro

System	Basic	Mono	Colour	Multiscan
410/1	£1099	£1159	£1288	£1488
420/1	£1499	£1559	£1678	£1888
440/1	£2099	£2159	£2278	£2488

(Securicor carr. £10 on Archimedes)



Archimedes A3000

- A3000 Microcomputer £599
- A3000 + Learning Curve pack £699

- 3.5" External Drive £99
- Monitor Stand £22
- External Podule Case £14
- Serial Upgrade £19
- A3000 Technical Manual £29
- Dust Cover Micro only £5
- Dust Cover for Micro + Monitor £9
- User port/MIDI upgrade £49

Unbeatable SUMMER SALE

Offers on Archimedes Micro
(Extended by Popular Demand)

When you purchase an Archimedes Micro from Watford, look what you get FREE with it

Micro	Free Offer
A410/1	Upgraded to 2MB RAM & a 20MB Hard Disc, (A420)
A420/1	Upgraded to 4MB RAM & a 40MB Hard Disc, (A440)
A440/1	A TAXAN 775+ Multyscan Monitor
A3000	Upgraded to 2MB RAM on board

+ 12 months FREE On-Site Maintenance

ACCESSORIES

- NEW Multitasking RISC OS £29
- ROM Podule (Computer Concepts) £45
- ROM Podule (C C) with Battery Backup £59
- 3.5" 800K 2nd Floppy Drive (305/310) £118
- 5.25" 800K external Floppy Drive £85
- I/O Podule (with Analogue port, User port, & 1MHz bus) £80
- MIDI add-on to I/O Podule £29
- MIDI Expansion Card £65
- Sound Sampler Mono (Armadillo) £129
- Sound Sampler Stereo (Armadillo) £166
- Sound Sampler Stereo /Midi (Armadillo) £186
- Chromalock Podule (Wild Vision) £275
- Econet Network Board £46
- Archimedes IEEE Interface Adaptor £269
- Dual RS232 Podule £195
- 16 bit parallel I/O Card £195
- NEW – Archi MK II Replacement Mouse £39
- PC Emulator NEW Faster Version £68
- Software Developers Toolbox £159
- Floating Point Unit £549
- SCSI Adaptor Expansion Card £185
- Keyboard Extension Lead £6
- 2 Podule Backplane £25
- 4 Podule Backplane £38
- Fan for above backplanes £8
- Archi Real-time digitiser £199
- RB2 – Archi Marconi Trackerball £46
- Risc Os Extras Software Disc £5
- Smoked Perspex Low profile Keyboard Cover £6

Archi Books, see page 12 of our advert

Turbo Charge Your Archimedes

(at an affordable price)

Increase the speed of your Archimedes by a factor of THREE to SIX times (depending on the software you are running), with Watford's ARM3 Upgrades.

- ARM-3 20MHz Upgrade Board £349
- ARM-3 30MHz Upgrade Board £399
- MEMC 1A Upgrade £49

Convert your Archi 410 to a 420 or 440 with Watford's unique Upgrade Kits

UP10 – to 2MB RAM + 20MB Hard Disc	£254
UP15 – to 2MB RAM + 40MB Hard Disc	£359
UP20 – to 4MB RAM + 20MB Hard Disc	£420
UP30 – to 4MB RAM + 40MB Hard Disc	£539
UP40 – to 4MB RAM + 53MB Hard Disc	£599

Archimedes RAM Upgrade

All our memory upgrades are simple to fit. No soldering required.

- R302-A3000 – to 2MB RAM Upgrade £95
- R304-A3000 – to 4MB RAM Upgrade £299
- R311-A305 – to 1MB RAM Upgrade £99
- R312-A305/310 – to 2MB RAM Upgrade £285
- R314-A305/310 – to 4MB RAM Upgrade £499
- R412-A410/1 – to 2MB RAM Upgrade £85
- R414-A410/1 – to 4MB RAM Upgrade £255

(Carriage on Add-ons £3)

Watford's 20Meg & 40Meg Archimedes Hard Disc

Watford's Hard disc drives for A310 & A410 series fit internally into the space provided. The 'simple to follow' fitting instructions supplied makes drive fitting very easy. All disc drives are self parking. 40Meg & 53Meg drives are fast 24mS type.
P.S. A310 upgrades require a backplane and a fan.

- 3HDP – Hard Disc Podule only £175
- 3HD20 – 20Meg H' Disc + Podule for 310 £319
- 3HD40 – 40Meg H' Disc + Podule for 310 £439
- 4HD20 – 20 Meg Hard Disc for 410 £169
- 4HD40 – 40 Meg Hard Disc for 410 £285
- A3000 Hard Disc Podule only £195
- A3000 20 Meg Hard Disc + Podule £369
- A3000 40 Meg Hard Disc + Podule £489

(Carriage £7)

SILICON VISION Corner

Data Vision	£74	Film-Maker	£59
Gerber Plot	£93	Office Tools	£219
Risc Basic	£74	ROBO LOGO	£54
Solid CAD	£74	Share Holder	£74
Super Plot	£20	Solids Render	£59
Super Dump	£20	Solid Tools	£199
Arc PCB Professional			£275
Realtime Solids Modeller			£110

LANGUAGES (Archimedes)

ISO-PASCAL; FORTRAN 77			£89 each
ANSI C Release 3			£129
Assembler; LISP or Prolog X			£155 each
LOGOTRON LOGO			£55
ROBO LOGO	£54	TWIN EDITOR	£25
RISC BASIC	£85	BASIC Compiler	£89

(P&P £2 on above packages)

Desk Top Publisher

Acorn's Archi DTP Package	£125
Impression DTP Package	£135
Impression 2 DTP Pack	£165
Impression Junior	£79
Tempest DTP Package	£99

ARCHI WORDPROCESSORS

Wordwise + Disc	£20	P.Spellchecker	£40
Image Writer	£25	View	£45
Interword Disc	£20	Viewspell	£32
1st Word Plus – 3	£72	Viewindex	£12
Archie Spell Master	£39	Graphic Writer	£23

DATABASES

AlphaBase	£36	Interbase Disc	£20
Knowledge Organiser	£45	Multistore	£195

SPREADSHEETS

Intersheet Disc	£20	Viewsheet	£45
Sigmasheet	£55		

BUSINESS GRAPHICS

GammaPlot	£50	Interchart Disc	£20

INTEGRATED PACKAGES

Logistix – Database, Spreadsheet, Time Management & Business Graphics £89
Pipedream 3 – Wordprocessor, Database & Spreadsheet £125
(P&P on above £2)

GRAPHICS, ART, DESIGN & GAMES

GRAPHICS

Atelier	£84
Artisan II	£59
Pro Artisan	£85
Autosketch II	£75
Graph Box	£64
Kermit	£46
Render Bender	£59
Euclid 2	£57

GAMES

Alerion	£11
Apocalypse	£25
Arcade Soccer	£17
Bug Hunter	£14
Battle -Tank	£14
Clares 3 Pack	£12
Conqueror	£19
Enthar Seven	£22
E-Type	£17
E-Type Designer	£15
E-Type Extra 100 miles	£18
Freddy's Folly	£10
Holed Out Designer	£17
Holed Out Golf	£17
Hyperpack (12)	£79
Hoverbod	£11
Ibix the Viking	£14
Inter Dictor	£25
Jet Fighter	£10
Man at Arms	£17
Minotaur	£11
Missile Control	£11
Mogul	£14
Olympics	£17
Orion	£12
Pacmania	£14
Repton 3	£17
Sporting Triangles	£24
Talisman	£14
The Pawn	£19
Thundermonk	£11
Zarch	£15

Miscellaneous

Armadeus Sound	£69
DFS Reader	£15
Toolkit (Clares)	£42
Hearsay Comms Pack	£55
Arccomm Pack	£29
Genesis	£65

Archimedes to BBC Serial Link Mk 2

Using this simple data link, it is possible to solve all your BBC to Archimedes data transfer problems. The kit is supplied with a disk, and the necessary cable to connect the two computers.
New RISC OS Version **Only £15**

Archimedes 5.25"/3.5" Disc drive Interface

With this interface it is possible to connect almost any 5.25"/3.5" disc drive with its own power supply to the Archimedes. Upto 4 disc drives can be connected. NO SOLDERING is involved. Supplied complete with necessary lead.

Only £21

MINERVA's Archimedes Software

Sigmasheet	£55	Sales Ledger*	£53
Home Accounts*	£40	Purchase Ledger*	£53
Stock Manager*	£53		
Nominal Ledger*	£53	Reporter	£29
Ancestry	£59	Mailshot*	£29
Gammaplot	£50	MultiStore	£195
System Delta+	£55		

System Delta + Reference Manual	£25
Order Processing/Invoicing*	£53
School Administrator	£118

** Requires System Delta*

Watford's Summer Sale

Many customers have asked why Watford does not have a Summer Sale. As we could see no reason why we should not, for once we are having a truly spectacular sale with some of the lowest prices you have probably ever seen.

ARCHIMEDES ADD-ONS

- Archi Real-time Digitiser £199
- SCSI Adaptor Expansion Card £175
- Dual RS232 Podule £195
- Archi Graphic Tablet £210
- Archi Mk II Hand Scanner £129
- A3000 Hand Scanner £169
- Archi Mk II Spare Mouse £34
- Logistix £85
- Pipedream 3 £112
- Atelier £79
- Artisan II £55
- Euclid 2 £54
- Render Bender £55
- Robo Logo £49
- Solids Render £54
- A3000 RAM Upgrade to 2Meg £70
- A3000 RAM Upgrade to 4Meg £245
- 2MB RAM Upgrade – A310 £245
- 4MB RAM Upgrade – A310 £449
- 2Meg RAM & 20Meg H/Disc – A410 £232
- 4Meg RAM & 20Meg H/Disc – A410 £379
- 4Meg RAM & 20Meg H/Disc – A410 £472
- 4Meg RAM & 40Meg H/Disc – A410 £525
- A3000 20 Meg Hard Disc Drive £359

BBC B & MASTER ACCESSORIES

Master ROM Cartridges Twin £8; Quad £12

- DFS Kit £59
- Rom Manager £18
- VIEW 3.0 £42
- DDFS Mk 2 Kit £42
- View Store £33
- View Sheet £34
- Disc Doctor £20
- Over View £60
- Inter Word £34
- Inter BASE £44
- Spellmaster £39
- Wordwise + £34
- Word Aid £20
- Quest Mouse Mk 2 & Quest Paint £54
- AMX Mouse Mk3 & Superart £54
- Quest Paint £29
- Conquest £27
- Wapping Editor £49
- Wapping Editor with Mouse £69
- Solderless Sideways ROM Board £32
- User Port Splitter Unit £20
- Sideways ROM ZIF Socket £16
- B-32 Shadow RAM Card £55
- B-12 Sideways ROM Board £33
- 32 Shadow RAM Expansion Card £55
- ROM/RAM Card 32K £44
- ROM/RAM Card 128K £99
- Beeb Video Digitiser £99
- Beeb Hand held Scanner £125

DISC DRIVES

- CLS400S £69
- CS400S £79
- CLD800S £139
- CD800S £149
- CLS35 £62
- CLD35 £109

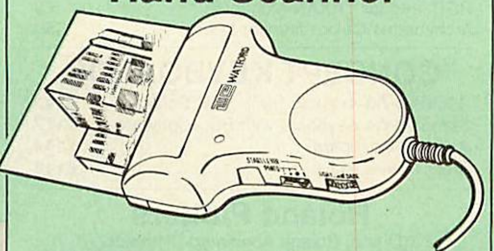
MONITORS

- Microvitec 1431 £165; 1451 £205
- Philips 7502 £68; CM8833 £199
- TAXAN 775+ £396; EIZO 8060H £379

PRINTERS

Panasonic KX-P1081	£120;	KX-P1180	£129
Panasonic KX-P1124	£205;	KX-P1624	£325
Panasonic KX-P4420	£899;	KX-P4450	£1225
Integrex Colourjet 132 Printer			£475
Star LC10	£127;	LC10 Colour	£165
Epson LX400	£127;	Epson LQ400	£194

Archi Mk II Hand Scanner



Watford Electronics is now able to offer a complete hand held scanning package, possibly the most essential addition to any desk top publishing system. The package includes the most comprehensive utility software available for the Archimedes, a high quality, ergonomically designed to fit the shape of your hand, (see drawing above) scanner, which is fitted with a warning LED that will indicate if the scanner is being moved too quickly for accurate results. Additional twin guide rollers ensure precise tracking over the image, to make the best use of the high resolution available with this sytem. The yellow/amber illumination of our Mk II scanner, enables you to achieve optimum accuracy. It is capable of scanning upto an amazing 400 DPI. The scanning area is 4" wide and the height is only limited by the maximu amount of memory available.

On board ROM software supplied, is the most sophisticated Archimedes scanner software yet written.

AHS-4	**Archi 300/400 Version**	**£149**
AHS-3	**Archi A3000 Version**	**£175**

Z88 Portable Micro



Only: **£195** (Carr £4)

FREE

With every Z88 purchased from us, we are giving away absolutely FREE, a Z88 to BBC Interface Link, 4 rechargeable batteries and a compact Mains Battery Charger worth £38.

ACCESSORIES

- 32K RAM Pack or 32K EPROM Pack £18.00
- 128K RAM Pack or 128K EPROM Pack £45
- 512K RAM Pack £175
- Z88 Eprom Eraser Unit £35
- Z88 Spellmaster for Pipedream £51
- Z88 Carrying Case £9
- Z88 Computing Book £9.95
- AA Nicad Rechargeable Battery £1.50
- Battery Charger Compact & Fast £6
- Z88 Serial Printer Cable £9
- Z88 Parallel Printer Cable £25
- Z88 to Archi Link £15
- Z88 to BBC Link £20
- Z BASE £56
- Z88 to PC Link II £30
- Z TAPE £42
- Z88 to Macintosh £52
- Z TERM £42
- Z88 Mains Adaptor £9
- Z88 Modem £149



CREDIT CARD 24 HOUR Ansaphone Hot Lines (0923) 50234 or 33383

By popular demand, we are now supplying refurbished and fully guaranteed BBC Micros with Disc Filing System
(Please telephone for price & availability)

ULTIMUM – Archimedes A3000 Podule Racking System

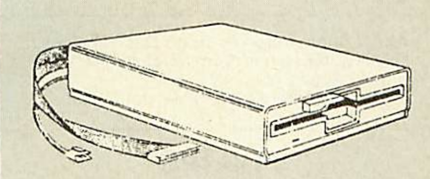
When Acorn originally designed the Archimedes micro, they released to all interested parties the specification of the expansion podule. This has now become the accepted standard for all manufacturers of Archi peripherals. The A300 & A400 both allowed expansion internally up to 2 or 4 podules. However, a newcomer to the affray has caused some upset. A3000 has only a single podule expansion slot, on the outside. There has been deliberation in the industry about a controversial "mini-podule" to be fitted to a special rack. This would entail a re-design of all the available podules onto a smaller board and understandably the manufacturers have rejected the idea completely. As always, Watford have come up with the only real solution to the A3000 expansion problem. The Ultimum Podule Racking System allows up to 3 full size standard A300/A400 series podules to be fitted to the computer. There is also provision for a hard disc drive and podule. Ultimum has its own PSU. There is also an IEC mains output socket for a monitor. It mounts on top at the rear of the computer, and allows direct access to the floppy drive and reset button, rather than obstructing access as on other non standard systems.

Watch this space for launch details.

BBC MASTER

MASTER 128K Micro incl. Acorn's View, Viewsheet, ADFS, BASIC Editor & TERMINAL plus FREE OFFER (see below) **£399** *(carr £7)*

FREE OFFER



A 5.25" Double Sided, 40/80 track switchable 400K Disc Drive complete with cables and a Utilities disc incl. 2 games, plus

Gemini's OFFICE MATE & OFFICE MASTER packages on Disc consisting of: Database, Spreadsheet, Beebplot graphics. Accounts packs: Cashbook, Final Accounts, Mailist, Easyledger, Invoice & Statements, Stock Control.
FREE with every BBC Master purchased from us during August

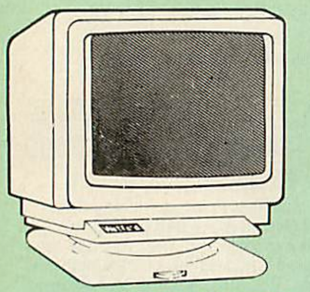
ADD-ONs & ACCESSORIES

Turbo 65C102 Add-on Module	£115
Econet Module for the Master	£47
Twin ROM Cartridge for Master	£9
Quad ROM Cartridge for Master	£14
Master Reference Manual I	(No VAT) £14
Master Reference Manual II	(No VAT) £14
Master Advance Ref Manual	(No VAT) £17
64K Upgrade Kit for B+	£32
Acorn 1772 DFS Kit complete	£49
ECONET Upgrade Kit for BBC B	£42
ALL ECONET UPGRADES Available	
ARIES' IEEE Interface for BBC B & Master	£238
Morley Teletext Adaptor with ATS Rom	£99
Filestore E01S £899	Filestore E40s £749
Filestore E60S £949	Ecolink £270

(Carr. £2 to £7 depending on the weight)

Continued→ → → → → → → → → →

MONITORS





MICROVITEC 14"

- 1431 – Standard resolution as used on the BBC television computer programme £175
- 1451 – Medium resolution, suitable for word processing in mode 0 £219
- Cub3000 Medium Res for A3000 £195
- 1455 – MS Medium resolution, ideal for Archimedes £220
- 1441 – High res, exceeds the capabilities of the BBC Micro £359
- 1431AP RGB + PAL and AUDIO £199
- 1451AP RGB + PAL and AUDIO £255
- 2030 CS 20" Med Res £380
- 2040 CS 20" Hi Res £675
- Dust Cover for Microvitecs £5.50
- **Touchtec 501 Touch Screen £239**

14" MULTISCAN COLOUR

- TAXAN 775 Plus – 0.28 Dot pitch Ultra high resolution, anti-static screen £429
- TAXAN 770 LR Low Radiation, auto-scanning Ultra High Res £429
- TAXAN Multiscan 870 16" Monitor £575
- EIZO 8060H – For technical info. read the review in Micro User, Jan. '89 £389
- EIZO 9060SZ Low Radiation, Super High Resolution, Antistatic screen, multiscan monitor for a wide range of applications. 800 dots x 600 lines. Display for high res VGA. 0.28 Dot pitch £429

- TAXAN Super Vision 3 – High Res 12" Colour Monitor/with green screen switch for wordprocessing
  Special Offer **£179** (While stocks last)

PHILIPS

- BM7502 12" Hi-res Green Monitor £70
- BM7522 12" Hi-res Amber Monitor £71
- CM8833 14" Med. Res Colour Monitor £215

STAR BUY

- PHILIPS 14" Medium Res, dark glass, attractively finished Colour Monitor . A push-button switch toggles between Hi-Res monochrome green text mode and full colour display. (Please state the type of Connecting Lead you require).

ONLY £189

- PHILIPS 14" Refurbished monitor, same as above at a special offer price Only **£120** (Offer valid while stocks last)

Dust Cover for Philips Monitors £6
(Securicor carriage on Monitors £7)

SWIVEL BASES

By simply placing your monitor on one of our front adjustable professional swivel bases (see drawing at the top), you can easily adjust the viewing angle.

for 12" Monitors **£8** (carr. £2.50)
for 14" Monitors **£12** (carr. £2.50)

Anti Glare VDU Screen

These extremely effective, easy to install, 12" & 14" VDU screens eliminate harmful glare, improves contrast on colour monitors. Increases productivity in offices. A must for wordprocessor users.

£12

Spare Monitor Lead

BNC Lead for Zenith or Philips	£3
Skart Monitor Lead	£5
RGB lead for TAXAN Monitors	£3
Archimedes Colour Monitor Lead	£7.50

CONCEPT KEYBOARDS

Standard A3 Keyboard with BBC Software	£143
Standard A4 Keyboard with BBC Software	£117
Archi A3 Keyboard	£144
Archi A4 Keyboard	£118

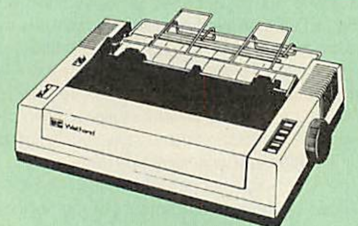
Roland Plotters

(Official Roland Appointed Distributor)

- **DPX 2500** £2495
- **DXY 1100** £595
- **DXY 1200** £835
- **DXY 1300** £1015

Panasonic KX-P1081





SALE OFFER only: **£127**

(Price includes, FREE a 4ft Printer Lead, and a Dump Out 3, Screen Dump ROM worth £35 with every KX-P1081 printer purchased from us)

KX-P1180 Printer Offer

Panasonic KX-P1180 printer, Dump Out 3, Screen Dump ROM & a BBC printer lead.

Offer Price £136

Panasonic Printers

- **KX-P1124** 24pin 80col. 192/63 CPS £215
- **KX-P1540** 24pin 136col. 240/80 CPS £415
- **KX-P1592** 9pin 136col. 216/45 CPS £275
- **KX-P1595** 9pin 136col. 288/61 CPS £345
- **KX-P1624** 24pin 132col. 192/63 CPS £349
- **KX-P1640** £349
- **KX-P1695** 9pin 132col. 330/86 CPS £349

- **Panasonic KX-P4450i** LASER PRINTER
  Latest technology at Watford's special offer price **£1,225**
- Spare Toner **£29**
- A4 Feeder **£55**
- Drum Unit **£149**
- Developer **£115**

Panasonic Accessories

Cut Sheet Feeders

KX-P1592/1595 (P32)	£175	KX-P1540 (P35)	£175
KX-P1124 (P36)	£85	KX-P1180 (P37)	£79

BUFFERS

P12	4K buffer Board for 1081	£55
P42	32K buffer Chip for 1592/1595	£16
P43	32K Buffer Chip for 1540/1124/1180	£16

Serial Interfaces

P17 P1081/1592 **£32** **P19** P1124/1180 **£55**

Original Panasonic Ribbons

Guaranteed to last 3 million characters

P110	for KX-P1081, 1592 & 1595	£8
P115	for KX-P1180	£8
P145	for KX-P1124	£8
P140	for KX-P1540	£10

Colour Ribbons for KX-P1081, 1592 & 1595
Brown, Blue or Red **£9.95 each**

NEC PINWRITER

NEC P2+ Pinwriter			£219
NEC P6+ 80 colm	£329	P7+ 136 colm	£429
Colour Option	£74	Serial Interface	£73
Cut Sheet Feeder	£125		
NEC Ribbons for P6+	£8.50;	P7+	£9.50

INTEGREX COLOUR JET

- Colour Jet 132 Printer £515
- Paper Roll £6.50
- Screen Dump Software £10
- Colour Cartridge £19.50
- Colour Textile Cartridge £29
- Black Cartridge £11.25
- Black Textile Cartridge £17
- 100 A4 OHP transparencies £55
- 8K Serial Interface Optional £123

Citizen Printer

120D Plus	£105	Swift 9	£198
Prodot 9	£275	Prodot 24	£375
Swift 24	£245		
Swift 24 Colour Option			£34
Swift 24 Colour Ribbons			£13

Hewlett-Packard Printers

12 MONTHS FREE MAINTENANCE ON SITE

HP Desk Jet +	£549
HP Desk Jet Cartridge	£14
HP Desk Writer	£669
HP Laserjet IID	£845
HP Paint Jet Colour	£699
HP Quiet Jet Plus	£425
HP Scanjet Plus	£1199
HP Thinkjet	£269

Star Printers

- LC10 9pin 80col. 144/36 CPS £124
- LC10 Colour 9pin 80col. 144/36 CPS £160
- LC10-II 9PIN 80col. 180/45 CPS £155
- LC15 9pin 136col. 180/45 CPS £258
- LC24-10 24pin 80col. 180/60 CPS £189
- LC24-15 24pin 136col. 200/67 CPS £320
- XB24-10 24pin 80col. 240/80 CPS £379
- XB24-15 24pin 80col. 240/80 CPS £489
- XB-24 Colour Kit £35

Star Accessories

Cut Sheet Feeder

LC10/LC24-10	£65	LC15/LC24-15	£125
XB24-10	£80	XB24-15	£139

Serial Interfaces

SPC-10 LC10; LC10-II; LC10-Col; LC15; LC24-10; LC24-15	£49
8K Ser FR10; FR15; XB24-10; XB24-15	£64

BUFFERS

32K Ram Card for LC24-10 & 15	£55
32K Ram Card for XB24-10 & 15	£55

Ribbons

LC10; LC10-II; LC15,Black	£4
LC10 Colour Ribbon	£6
XB24-10 & XB24-15 Black	£5
XB24-10 & XB24-15 Colour	£12

LASER PRINTERS

12 MONTHS FREE MAINTENANCE ON SITE

Canon LBP-4		£849
Canon LBP-8 III		£1375
Canon LBP-8 IIIT		£1739
Canon LBP-8 IIIR		£1869
Epson GQ5000	6ppm	£860
HP Laserjet IIP	4ppm	£795
HP Laserjet IID	8ppm	£1899
HP Laserjet III	8ppm	£1249
Panasonic KX-P4420	8ppm	£949
Panasonic KX-P4450i	11ppm	£1225
Qume Crystal Print WP+		£775
Qume Crystal Print Ser. 2		£1099
Qume Crystal Print Postscript		£1999
Star LP-8 II		£1149
Star LP-8 II 2 Bin		£1595
Star LP-8 Star(post)script		£1695

Laser Toners

Canon 2	£60	Laserjet II	£79
Canon 4	£70	Laserjet IIP	£79
Epson GQ	£20	Panasonic	£29
Star	£–	Qume Crystal	£25

Laser RAM Upgrades

HP Laserjet II RAM		GQ5000	512k	£99
Jetware II 1MB	£199	KX-P4420	1M	£249
Jetware II 2MB	£349	KX-P4450i	1M	£299
Jetware IIP 1MB	£199	KX-P4450i	2M	£575
Jetware IIP 2MB	£479			

Handy Printer Switch

A handy two way compact printer switch that enables you to connect 2 Micros to 1 printer, or 2 printers to 1 Micro. Attaches easily to your printer, monitor, etc. A low cost solution for educational establishments. Ideal for those wishing to use a dot matrix and a laser printer. Available in two configurations.

Compact AB Switch Centronics	£19
Compact AB Switch RS232	£18

(Cables extra at £6 each)

MEGABUFFER 256



The Smallest 256K Printer Buffer Unit in the world **38mm x 130mm x 134mm.**

This new Megabuffer 256 from Watford is a full featured 256K Printer Buffer. The features are:

- Improves efficiency by making more efficient use of computer and printer.
- Compatible with any computer and printer that uses Centronics Parallel connections including all BBCs, IBM PCs, etc.
- Total compatiblity with all software.
- Cheaper phone bills when using your Modems.
- Ideal for those doing large graphics screen dumps that are slow to print.
- Multi-Copy facility allows you to print several copies via Megabuffer without going through your computer.
- Data Dump facility is included.
- Built in text unit for both the buffer & your printer.

Only £119 (carr £5)

Epson Printers

EX800	£429	LQ1050	£540
EX1000	£564	LQ1060	£649
FX850	£315	LQ2550+	£849
FX1050	£385	LX400	£129
FX1060	£679	LX850	£179
LQ400	£198	SQ850	£515
LQ850	£439	SQ2550	£789
LQ550	£269	TLQ4800	£1449
LQ860 Colour	£535		

CUT SHEET FEEDERS for

EX800/FX800/850/LQ800/850	£130
FX1000/LQ1000/1050	£175
LQ2550	£390
LX400/800/850/LQ400/500/550	£69

TRACTOR FEED for

LQ800 **£44**; LQ850/FX850 **£69**; LQ1050/FX1050 **£85**; LQ2500 **£90**; LQ2550 **£90.**

ACCESSORIES

● EX800/1000 Colour Option	£45
● EX800/1000 Colour Ribbon	£14
● LQ2500 Colour Option	£65
● Multifont Card for LQ550/850/1050	£95

Epson Printer Interfaces

All these interfaces fit inside the printer

RS232	£32	RS232 + 2K Buffer	£52
IEEE 488	£40	RS232 + 8K Buffer	£79

PRINTER LEADS

BBC Centronics 4' long	£5
BBC Centronics 6' extra long	£7
Compact's Special Centronics Lead	£7
Archimedes Printer Lead 6'	£6
Nimbus Centronics Lead	£6
IBM Parallel Lead 6'	£6
Double Ended 36 way Centronics Lead 4'	£7
Double Ended 36 way Centronics Lead 6'	£9
MSX Centronics Parallel Lead 4'	£12
RS232 Leads (Various)	P.O.A.

Universal Printer Sharers/Changer

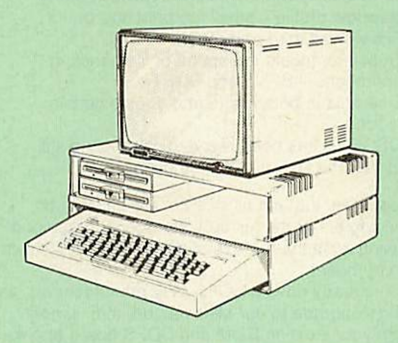
Connect upto 5 Micros to 1 printer or 5 Printers to 1 Micro with our combined, Sharer/Changer. These Units are made to a very high standard. For extreme reliability, they all have Printed Circuit Boards mounted inside the case, (not a Spaghetti Junction of wires). Internal connection is made via high quality ribbon cables.

(Ideal for School environments)

Connects	Serial	Centronics	P&P
2 to 1	£20	£22	£3
3 to 1	£27	£30	£3
5 to 1	£36	–	£4

(Cables extra at £6 each. Please specify type required when ordering)

Plinths for BBC Micro, Master & Printer



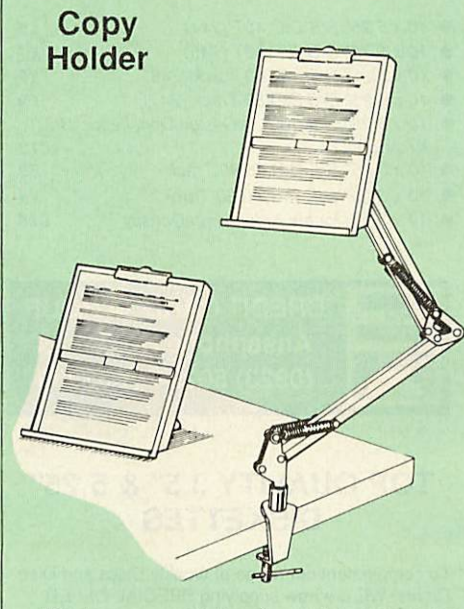
Protect your computer from the heat of your VDU. Our micro plinths have slots for maximum ventilation. The single plinth is suitable for a BBC and VDU, whilst the double height version provides enough room for our stacked disc drive and other peripherals like, Eprom programmer, music unit or simply discs & stationary. The computer slides neatly in the lower section allowing easy access to remove the lid.

The single printer stand is equally sturdy but instead of cooling slots it has elegant cutouts on the sides. This allows easy access to paper from all sides. Colour: BBC Beige.

Single BBC Plinth	420 x 310 x 105mm	£13
Double BBC Plinth	420 x 310 x 210mm	£24
Printer Plinth	420 x 310 x 105mm	£12
Single Master Plinth	490 x 310 x 105mm	£14
Double Master Plinth	490 x 310 x 210mm	£26

(Carr. Single plinth £2; double plinth £3)

Copy Holder



Whether you want to type in your latest program or the draft of a new trilogy, Watford's manuscript holders are superb for holding you paper at the ideal height and angle to allow you to read and type in ease and comfort.

Available in 2 full A4 versions, desk resting and shelf clamping. Paper is held firmly by means of a plastic retaining ruler and a clip grip. (for resting books or magazines, the desk top version is recommended).

Desk Top **£7** (carr. £3)
Angle poise **£12** (carr. £3)

Listing Paper (Perforated)

● 1,000 Sheets 9.5" x 11" Fanfold Paper	£7
● 2,000 Sheets 9.5" x 11" Fanfold Paper	£11
● 1,000 Sheets 9.5" x 11" NCR 2 Part Fanfold	£21
● 1,000 Sheets 15" x 11" Fanfold Paper	£9
● 1,000 Sheets true A4 Fanfold Paper 70gms	£11
● 2,000 Sheets true A4 Fanfold Paper 70gms	£21
● Teleprinter Roll (Econo paper)	£4

(All our Fanfold paper is Micro perforated leaving a smooth clean edge when the tractor feed strips are detached).

Carriage 1K Sheets £2.50, 2K Sheets £3.00

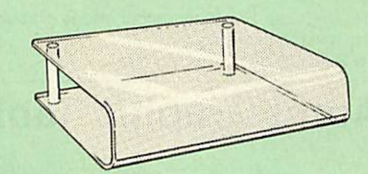
PRINTER LABELS

(On continuous fanfold backing sheet)

1,000 90 x 36mm (Single Row)	£5.00
1,000 90 x 36mm (Twin Row)	£4.90
1,000 90 x 49mm (Twin Row)	£7.50
1,000 102 x 36mm (Twin Row)	£6.25

Carriage on 1,000 Labels £1.00

Perspex Printer Stand



Give you Computer System a touch of Class with our elegant, smoke finished Perspex Printer stand.

80 Column version	**£16** (carr £3)
136 Column version	**£20** (carr £4)

Professional Printer Stand



The professional printer stand takes hardly more space than your printer. Due to the positioning of the paper feed and re-fold compartments ie. one above the other, the desk space required for your printer functions is effectively halved. Its ergonomic design ensures smooth paper flow and automatic refolding.

80 Column version £28 (carr. £3)
132 Column version £30 (carr. £4)

Printer Ribbons & Various Dust Covers

Type	Ribbons	Dust Covers
Brother HR15/20	£3.50	–
BBC Micro	–	£3.50
BBC Master	–	£4.00
Archimedes Micro pair	–	£9.00
Citizen 120D	£3.95	£4.50
DMP2000	£3.75	£4.75
EX/LQ800	£4.50	£4.50
EX/LQ1000	£6.75	£5.00
RX/FX80/85/800/MX80	£3.25	–
FX/MX/RX100/1000	£5.00	–
Kaga/Taxan KP810/815	£4.90	£5.00
LQ500/550/800/850	£4.50	£6.00
LQ1050/LQ2500	£7.00	–
LX80/86/800/850	£3.25	£4.50
M1009/GLP	£3.80	£3.75
NEC P2200	£6.00	£5.00
Panasonic KX1080/81	£3.50	£4.75
Panasonic KX-1124	£8.00	£5.00
SQ2500	£23.00	£5.50
Star LC10/NL10	£4.25	£5.00
Star LC24-10	£5.00	£6.00
Olivetti Ink Jet Cartridges (set of 4)	£9	

Our attractive Dust Covers are manufactured from translucent PCV. The seams are stitched and edges are taped to prevent splitting due to continuous use.

Continued→ → → → → → → → →

Archimedes Real-Time Digitiser

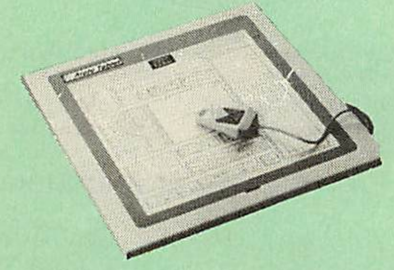
Now supplied with NEW RISC OS Version Software

Watfords' Archimedes Video Digitiser is the most sophisticated digitiser ever designed for a micro. It provides a fast and flexible means of capturing images from a video camera or recorder for display and manipulation on the Archimedes range of Micros. Off-air televison signals may also be digitised via a video recorder or TV tuner. Please write for further details.

Price £215

A Set of Colour Filters for colour image grabbing using a video camera	£16
New Risc-OS Software Upgrade	£39

Archi Graphic Tablet



The Archi Graphic Tablet offers performance and accuracy comparable to other tablets priced at well over £400, and has the useful addition of a liftable cover, which can hold tracing material or menu templates securely. The package is supplied complete with sophisticated Archi software. (Now, fully LinCAD compatible. Recommended by Linear Graphic).

(FREE this month, PC Mouse Drivers & Art package)

(For further details, please write in or telephone for our descriptive leaflet).

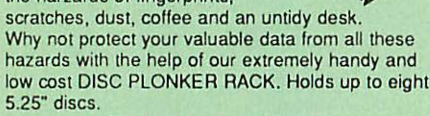
Special Price £249

(Price includes Tablet, Leads, Software & Puck)

Stylus Optional Extra **£29**

DISC PLONKER RACK

When using ones micro, there is a tendency to have more than one Disc on the desk. This exposes them to the harzards of fingerprints, scratches, dust, coffee and an untidy desk.



Why not protect your valuable data from all these hazards with the help of our extremely handy and low cost DISC PLONKER RACK. Holds up to eight 5.25" discs.

Protection at Only: £2

Acorn & Watford DFSs

- Watford sophisticated DFS ROM — £16.00
- Watford DFS Kit complete — £69.00
- We will exchange your existing ROM for Watford's ultimate DFS ROM at only — £12.00
- DFS Manual (comprehensive) — £6.95
- Acorn DNFS ROM — £17.00
- Acorn ADFS ROM only — £25.00
- Acorn 1772 DFS ROM Kit — £49.00

(The single Density DFS system is now old technology. Like Acorn, Watford too have decided to replace it with the their more up-to-date 1770 DDFS interface. We have informed most of the software houses of this decision in order that they can ensure compatibility with our highly sophisticated and fully Acorn compatible DDFS).

Watford's MkII 1772

Single/Double Density DFS

Many of our customers have wanted to use our superior DDFS and Acorn ADFS together. Now our Mk II DDFS Board with its 1770 Disc Controller, has been adapted to allow the use of Acorn ADFS as well. It also has all the commands of the Acorn's 1770 DFS, plus the added features.

Added features include:

- Acorn ADFS compatible – Use ADFS on our DDFS board.
- Tube host Code – No longer any need to have the DNFS in your machine to use Co-Processors, even the CoPro and Master 512.
- Auto 40-80 Track sensing – no need to fuss with 40/80 track switches (even works with protected disks).
- An extremely powerful 8271 emulation – ensuring compatibility with almost all software.
- New low profile – small footprint board.
- Fits with all third party ROM boards.
- Option to double the speed of file handling operations – BPUT and BGET.
- Operates in both single and double density modes.
- OSGBPB has been recoded, increasing still further the speed of file handling.

Please note that not all DDFS's are capable of providing either the full 80% storage increase or of allowing a file the full size of the disk – Ours allows both of these!

If you already have a DDFS (any manufacturer), and wish to upgrade to our MkII version, then simply return your existing ROM and DDFS board and we will supply the new DDFS for only **£39.00.**

- SPECIAL PRICE — £44.00
- DDFS Manual — (No VAT) £6.95
- We will exchange your existing DFS Kit for our sophisticated DDFS for only — £30.00

Please note, as the MkII DDFS is a hardware and sofware upgrade, it is not possible for existing Watford DDFS users to simply exchange the ROM for the new version.

3M – DISKETTES

3M – SCOTCH Diskettes with Lifetime warranty from Watford Electonics your 3M Appointed Distributor

- *10 x 5.25" S/S D/D 40T (744)* — *£5*
- *10 x 5.25" D/S D/D 40T (745)* — *£7*
- *10 x 5.25" S/S D/D 80 Track (746)* — *£8*
- *10 x 5.25" D/S D/D 80 Track (747)* — *£9*
- *10 x 5.25" 1.6M D/S D/D High Density for IBM XT and AT* — *£13*
- *10 x 3.25" S/S D/D 40/80 Track* — *£9*
- *10 x 3.25" D/S D/D 40/80 Track* — *£8*
- *10 x 3.5" Double Sided High Density* — *£18*



CREDIT CARD 24 HOUR Ansaphone Hot Lines (0923) 50234 or 33383

TOP QUALITY 3.5" & 5.25" DISKETTES

To complement our range of Quality Discs and Disc Drives. WE are now supplying SPECIAL OFFER packs of 10 Lifetime guaranteed discs. Each disc has a reinforced hub ring. Supplied complete with selfstick labels and a Plastic Library Disc Box.

- *10 x **M3** 3.5" D/S D/D 80 Track* — *£8*
- *10 x **M9** 3.5" D/S High Density* — *£17*
- *10 x **M4** 5.25" S/S D/D 40 Track* — *£5*
- *10 x **M5** 5.25" D/S D/D 40 Track* — *£7*
- *10 x **M7** 5.25" D/S D/D 80 Track* — *£8*
- *10 x **M8** 5.25" D/S H/D Hi-Density* — *£13*
- ***M2** 3" Double Sided* — *£3 each*

FLOPPY HEAD CLEANER KIT

The heads in floppy drives are precision made and very sensitive to dirt. The use of cleaner Kit is a sensible precaution against losing valuable data. It is recommended to clean the drive head once a week. it is very simple to use. Available in 3.5" & 5.25", please specify.

Price £4

ANTISTATIC LOCKABLE DISC STORAGE UNITS



Gives double protection – Strong plastic case that affords real protection to your discs.

Antistatic helps avoid data corruption whilst in storage. The smoked top locks down.

Dividers and adhesive title strips are supplied for efficient filing of discs.

- **M35** – holds up to 50 5.25" discs — £4.95
- **M85** – holds up to 95 5.25" discs — £6.95
- **M25*** – holds up to 25 3.5" discs — £4.95
- **M50** – holds 50 3.5" discs — £6.50
- **M10** – holds 8 of No. 10 Data Cartridges — £15

* Not lockable

PLASTIC LIBRARY CASES



Holds up to 10 5.25" Discs. **Only £2.00**

DUST COVERS (For our Disc Drives)

Single CLS (without PSU)	£3.20
Single CS (with PSU)	£3.25
Twin CLD (without PSU)	£3.85
Twin CD (with PSU)	£3.90

DISC ALBUMS

Attractively finished in black leather-look vinyl. Stores up to 20 discs. Each disc can be seen through the clear view pocket.

£4

Special BULK OFFER on 5.25" DISCS

(Supplied packed in Anti-Static Lockable Storage Units)
(Lifetime warranty on Discs)



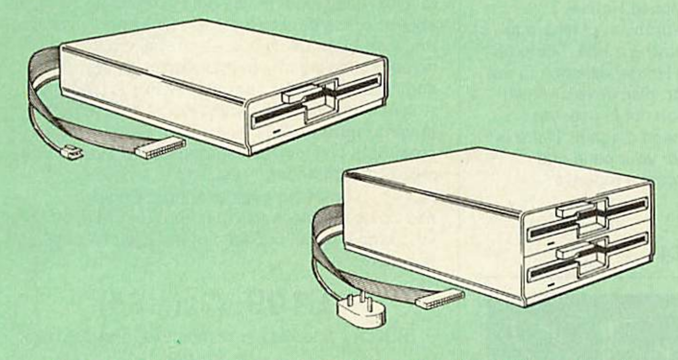
BULK PACK DISCS in lots of 100

Type	S-S 40T	D-S 40T	D-S 80T
Without Sleeves	£30	£35	£40
With Sleeves	£33	£38	£43

Quality Disc Drives from Watford

To help you decide which drive is the most suitable for your needs (and your pocket!), we have produced the table below.
The tinting on some of the boxes is used to indicate which Drives are 40 track (non-tinted) and which are 80 track (tinted). All our 80 track drives are already fitted with a 40-80 select switch.
***All our Disc Drives are Double Sided and will operate in both Single and Double Density modes.** Extensive experience of the usage of disc drives suggests that the JAPANESE drives currently represent about the best in terms of speed, reliability and overall "elegance" available for the BBC Micro.*
Various UK "manufacturers" of disc drives for the BBC micro (more accurately, "packagers" label other manufacturers drives with their own name). We buy the high qulity NEC and Mitsubishi drives in large quantities directly from the manufacturers, package them and sell them at "dealer" prices direct to the public. If you look around the popular BBC micro press, you will find that the prices we quote for the top quality, new slimline disc drives are, virtually without exception, some of the best around. These prices, coupled with the backup of one of the country's largest distributors of BBC peripherals provides a superb deal.
*Unless you anticipate using dual drives in a fully expanded BBC system for long periods of time with little ventilation, then we suggest that our range of "CL" disc drives without the PSU (Power Supply Unit) would be quite adequate (extensive tests within our workshops have confirmed this). All drives are supplied complete with a SPECIAL UTILITIES Disc, Cables and Plugs. The Drives with power supply have a mains moulded plug for safety purposes. **Ideal for Schools & Colleges.** We are now able to supply all single disc drives with Power Supply, in either single or dual case. (Dual case has a twin data cable and a power supply capable of driving two disc drives) allows easy expansion to a dual drive unit, at a later date. Prices stated in the pricing boxes below are for single drives in standard single cases. Single drives in a dual case cost an extra £18. (At Watford we anticipate your needs of tomorrow, not just today!)*
When using a BBC Micro, most people find themselves short of desk space. The Watford's BBC Micro plinths form an ideal way of recovering some of this precious space) your BBC Disc Drive and Monitor can all occupy the same vertical footprint and still be comfortably situated. With the Watford Double plinth, your Disc Drive is mounted vertically at one side, leaving a very valuable area directly in front of you for such useful items as spare discs, pen, paper, reference manuals, etc. Follow the trend with a Watford plinth. (Turn to the 4th page of our advert for the Plinths).
P.S. All our 5.25" Disc Drives with PSU are compatible with the Compact Micro. All you require is the special Compact Disc Drive Cables designed by us.

Our Disc Drives conform to BS415



"Test Bureau Approved for Use in Education"

Capacity	Drives without P.S.U.		Drives with P.S.U.	
	Single	Twin	Single	Twin
400K (720K)	CLS400S £74		CS 400S £83	
800K (1,44M		CLD 800S £149		CD 800S £162

● TWIN Disc Drive Case, complete with Power Supply & Cables **£43**
Securicor carriage on Disc Drives £6 to £7

Prefix ***C** = Cased Drive*
***L** = Less PSU*
***S** = Single*
***D** = Double*

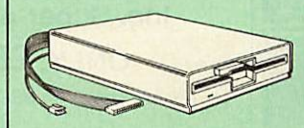
Suffix ***S** = 40-80 Switchable*

e.g. CLS400S = Cased Disc Drive, Less power supply unit, single 5.25" 400K, (720K in double density); Double sided; 40/80 track switchable.

Refurbished Disc Drives now available
CLS400S £50; CLD800S £98; CS400S £59; CD800S £115

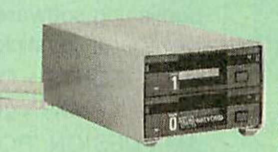
Special Cable to connect both 3.5" and 5.25" Disc Drives simultaneously to the BBC Compact £13

Special 40/80 Disc Drive/DDFS Mk II Offer



- The popular 40/80 track 400K single Disc Drive, Double Sided, cased with Cables. Plugs directly to your Micro.
- Watford's extremely popular DDFS Disc Interface (allows 720K storage). Will run in both Single & Double Density modes.
- A comprehensive User Friendly Manual.

A Bargain at Only **£119** (£7 carr) (Offer valid while stocks last)



3.5" DISC DRIVE OFFER

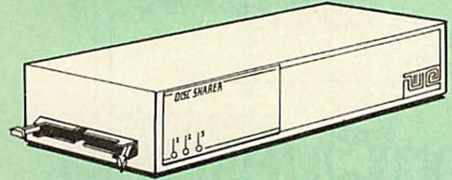
These top quality 3.5" Double sided, 80 track, 1 Megabyte (unformatted each Disc Drives), are attractively finished in BBC beige. They are supplied complete with all cables and a Utilities Disc.

Drives to connect to BBC Micros own PSU
- **CLS35 400K Unit £65**
- **CLD35 Twin 800K £119**

Drives with built-in Power Supply Unit
- **CS35 Single 400K £85**
- **CD35 Twin 800K £129**

(P.S. CS35 Single is supplied in a twin case with a blanking plate to enable easy expansion to a dual drive at a later stage).

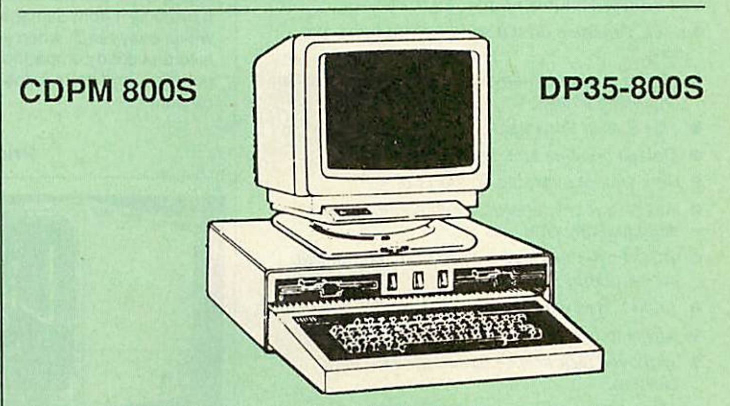
DISC DRIVE SHARER



(Ideal for educational establishments)
At last, a low cost alternative to the Econet system.Watford's Intelligent Disc Drive Sharer allows you to connect 3 BBC micros (model B, B+ and Master series) to a single or double disc drive. Running under any DFS or DDFS, this intelligent unit will automatically queue the computers. Each computer has a status light dedicated to it. If it is green you will get immediate access to the disk, and red means that you are next in line. The unit plugs directly into the disc drive socket on each computer and is powered by the mains. (N.B. Not for use with ADFS.)

Offer Price : **£55** Price includes 3 Cables

CDPM 800S DP35-800S



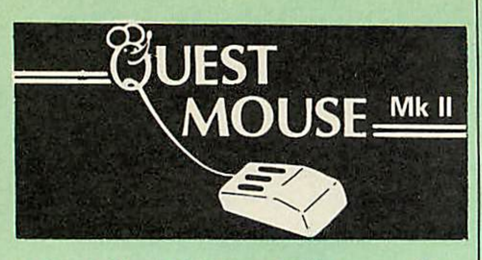
Twin 800K Double sided 40-80 track switchable disc drives mounted in an attractively finished Beige colour plinth for the BBC Micro. Supplied complete with integral power supply, cables and Utilities disc. The mains switch with neon On/Off light indicator, and the two 40/80 track switches are mounted on the front panel for ease of use.

CDPM 800S for the BBC B & Master £175

A Double disc drive with a difference! Times are changing fast for the floppy disk, and whilst the current standard for the BBC B and Master series is the 5.25" disk, the standard of the future will most certainly be the smaller; faster and more reliable 3.5 inch disks – now a standard feature of both the Master Compact and the Archimedes Series.
To support the present disc drive users, and cope with the future, we have designed our own plinth-mounted disk system – called the DP35 800S. It contains both the 5.25 inch and the 3.5 inch drive formats as well as offer a firm and rigid support for a monitor on top. With the BBC Micro underneath, the plinth makes a surprisingly small footprint on the desk – leaving you more space to work with.
The 5.25" disc drive is 40/80 track switchable. DP35-800S has its own power supply, independent of the BBC Micro.

DP35-800S for BBC/Master £165
(Securicor Carr. £7)
(The above drive units are 2 Megabytes unformatted)

Continued→ → → → → → → → →



- Quest Mouse II & Quest Paint £58
- Quest Mouse II, Quest Paint, AMX Stop Press & Pagefont £89
- Quest Mouse II only £29
- Quest Paint Software only £34
- Quest Font Disc (22 Text Fonts) £15
- Quest Mouse Mat (Red or Blue or Green please specify) £3
- Part Exchange your unreliable AMX Mouse for a Quest Mouse for only £22

(P.S. Quest Paint is not compatible with BBC Compact)



Winner of the BBC Acorn User 1990 Award for the Best Art/ Graphics software



Quest combined with ConQuest and Acornsoft GXR ROM make up THE MOST POWERFUL drawing packages available for the BBC range. Quest Paint is able to take advantage of almost any additions to your machine, such as Shadow or Sideways RAM. ConQuest takes this principal even further, by utilising the otherwise normally incompatible Sideways RAM facility by holding pictures in them.

Some of the features are:

- *Pick filenames off the screen for loading and saving.*
- *Rotate a cutout to any angle and Distort it to any four sided shape.*
- *Has Built in Font editor.*
- *Default brushes and patterns on startup.*
- *16 x 16 font available on start up.*
- *Ability to reset patterns, fonts and brushes to default at any time.*
- *ROM based enhanced Epson and compatible printer dump.*
- *ROM based enhanced extended picture routine.*
- *Ability to create and abort extended pictures.*
- *Improved disk access speed for extended pictures.*
- *User definable sideways RAM driver for incompatible sideways RAM systems.*
- *Ellipses at any angle on Master 128 (or B with GXR ROM).*

ConQuest ROM Package £30
(Price includes software in ROM and a comprehensive Manual).
(Not Compatible with BBC Compact)



An extremely reliable replacement mouse for Archimedes Micro £39

RB2 Marconi TRACKER BALL

RB2 (AMX/Quest compatible)	£45
RB2 including Quest Paint	£75
RB2-A for Archimedes	£46

THE NEW Mk III AMX MOUSE

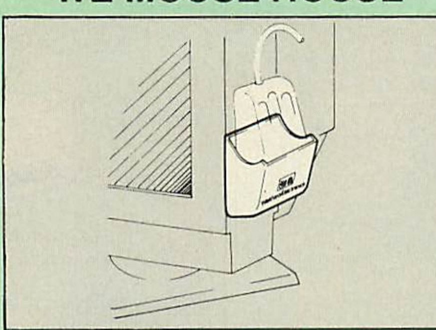
Inc. Super Art package

ONLY: £59 (carr £3)

(Please specify for BBC, Master or Compact)

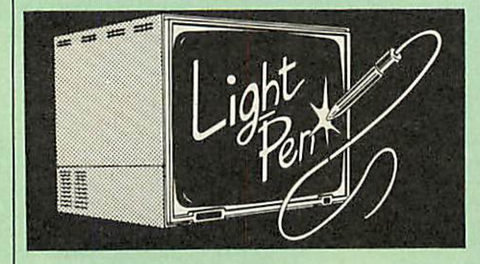
MOUSE MAT	£3
AMX MOUSE ONLY	£29
AMX SUPERART Package	£34
AMX STOP PRESS – A Desktop publishing software. Works with Keyboard, Joystick or a mouse	£32
PAGE-FONTS – Over 20 Fonts for use with AMX Pagemaker	£13
AMX DESIGN (ROM)	£55
AMX XAM Educational	£15
AMX EXTRA EXTRA	£16
AMX MAX A gem of desktop (ROM)	£20

WE MOUSE HOUSE



Treat your mouse to a cosy Mouse House. This handy little gadget solves the problem of where to store your mouse when it is having a rest. Made of sturdy plastic, the WE Mouse House attaches to the side of your computer, monitor, disc drive or desk. It protects it from damage when not in use, yet within easy reach when you need it again. There is also a second compartment for your pens and pencils – and at £4 it doesn't cost a rodent's ransom.

Price £4



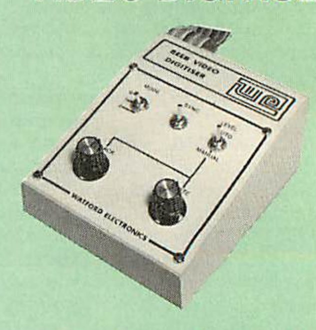
Our Mark II Light Pen is the very latest in light pen technology. It is totally insensitive to local lighting conditions and works with many different monitors. The pen only responds to the High Frequency light produced by your monitor/TV. An LED indicates when valid video data is being produced. A conveniently located switch is also fitted. (Price includes FREE software Disc and Operating Manual)

Only £21

FLEET STREET EDITOR

Software pack for BBC Micro	£33
Software pack for the Master	£39
Admin Xtra Disc Utility	£13
Fonts N Graphics Disc Utility	£13

BEEB VIDEO DIGITISER



"Test Bureau Approved for Use in Education"

Using any source of composite video (colour or monochrome) and the Watford Beeb Video Digitiser, you can convert an image from your camera into a graphics screen on the BBC Micro.
This uses the full graphics capacity of the BBC micro in modes 0, 1 or 2. The video source may be a camera, video recorder or television, and is connected via the video output socket.
Images produced can be compressed, stored to disc, printed on an Epson compatible printer, directly used to generate graphics, analysed for scientific and educational use or converted to other formats e.g. Slow Scan TV or receiving a picture from a remote camera using a modem. The output from the digitiser exactly matches the graphics capability in each mode, with up to 8 levels of grey in mode 2. The unit connects into the User Port and automatically scans a complete picture in 1.6 seconds.
Both the black and white levels can be adjusted manually for the optimum picture, or switched to automatic for unattended use. The image produced can be reversed if necessary.
Full controlling software is supplied on a normal sideways ROM and this is easily accessed via additional ★ commands. The package is designed to allow easy input of complex screens and give full access of the data to the user. Once on the screen, the image can be used as a normal graphics screen, allowing any of the usual graphics commands in BASIC or other ROMs to work on it.
A special print dump routine is included with the driver programs. This is specially designed to produce a fast, correctly proportioned picture, with reduced "contouring", resulting in an accurate reproduction of the original image. Detailed examples of driving this unit from BASIC or other languages are all provided in the extensive manual supplied.

£109 (Carr. £5)

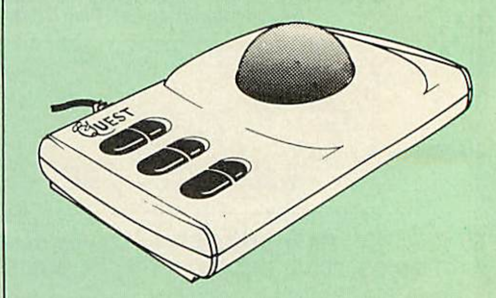
(BBC B+ and Master compatible, except Master with Econet)

(Price includes Digitiser Unit, Software in ROM & a Comprehensive Manual)

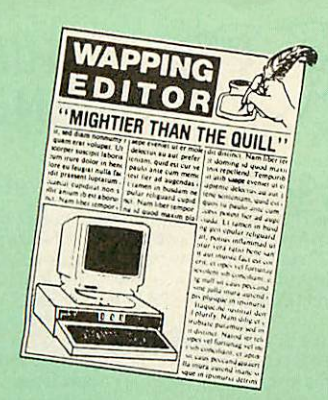
NEW

QUEST – Tracer ball

An attractively finished, extremely reliable, mouse replacement, input device. Requires very little desk space. Connects directly to your BBC B, BBC Master or Archimedes Micro.



QT-10 BBC/Master Version	£32
QT-20 Archimedes Version	£35





Winner of the BBC Acorn User 1990 Award for the Best DTP/ Word Processor

The WAPPING EDITOR

The Wapping Editor from Watford Electronics represents a breakthrough in Desktop Publishing for the Beeb. The package includes a 64K ROM containing ALL the software needed to get into print fast; a very sophisticated graphics module, professional quality typesetting software, a word processor, a comprehensive font editor for designing your own typefaces, and a variety of printer dumps. This mouse-driven system is designed for the BBC B, the B+ and Master computers and will take full advantage of any Sideways and Shadow RAM that may be fitted. It will run under DFS, ADFS and Network filing systems and requires as a minimum just a single 40 track drive.

Included with the system is a utility disc containing several high quality fonts, various utilities and a ROM image of a Support ROM. A comprehensive 100 page manual completes the package. The Support ROM contains routines to allow an area to be rotated to any angle or distorted to any four-sided shape. Also included are facilities to draw ellipses at any angle and sectors, segments and arcs (in Master or BBC B with Acorn GXR). Another of the features of the Support ROM is a 'Turbo DFS' which gives DFS access times comparable with those of ADFS.

PAGE LAYOUT SECTION

The Wapping Editor may be used to create pages of any size from an A6 to a full A3 page. If none of the eight default page types suit your purpose, the stand-alone page creation program may be used to create pages to your own requirements. By using proportionally spaced fonts and genuine microspacing it is possible to print over 150 characters across an A4 page. A unique feature of the Wapping Editor is the 'A5 x 2' page size allowing two A5 pages to be printed side by side onto a single A4 sheet.

The graphics module is a mode 0 version of the highly acclaimed Quest Paint package, and incorporates all the same drawing facilities, e.g. pencil, brush, airbrush, polygon, circle, ellipse, fill, cut-and-paste, etc., etc.

Text may be typeset, either justified or unjustified, in any font anywhere on the page. Simply select which font and text document you wish to use, and pull out a rectangle on the page where you want the text to be – it's as simple as that! Multiple columns may be printed just as easily and a special 'expand' feature may be used to expand the microspacing so that the document exactly fits the space defined.

WORD-PROCESSOR

The integral word processor is the ideal tool for producing your text documents, although text can of course be read in from any of the other popular word processors such as View, Wordwise etc.

cont./-

THE FONT EDITOR

The font editor module will allow you to design your own typefaces or to modify the ones provided on the utility disc. This sophisticated editor has numerous functions designed to take the tedium and frustration out of producing good looking, well balanced fonts. Each character may be individually proportionally spaced and characters of any size up to 16 x 16 pixels may be defined.
Upgrading to the Wapping Editor could not be easier since the font editor will convert fonts from other packages, such as Quest Paint or Stop Press (formerly Pagemaker), into Wapping Editor format and a mode conversion utility will convert any screen in modes 1, 2, 4 or 5 into a full grey-scale mode 0 screen. Pictures may also be 'grabbed' from a video source by using the Watford BEEB Video Digitiser, either independantly or from within the Wapping Editor package.

Wapping Editor Software Pack £69
Wapping Editor plus Mouse £89

(Wapping Editor only works with Master Compact if a Mertec Expansion box is fitted)

Wapping Art Disc

Over 250K of clip art to cut and paste into your Wapping Editor pages. Pictures include maps, transport, people, media, sport, games etc.
Two 'ratio' screens for use with hi-res and rotated A5 pages to ensure images are not distorted when printed out.

Music writing symbols in the form of pattern and brush for quick production of manuscripts are included together with staves.

There are two prepared hi-res pages layed out for printing labels, both single and double width. Ready made label designs are included but these can be easily replaced with your own designs.

A Mode 0 screen dump routine is also included. To pack such a large amount of data onto the discs the screens have been compressed and routines to compress and expand Mode 0 screens are included on both discs. Using the packing routine you can archive large numbers of screens onto a single disc.

£15

The Beeb HandScan
Hand-held Scanner for the BBC Micro



Watford Electronics are pleased to announce the launch of the first hand held scanner for the BBC Micro. HandScan is a compact unit which will allow photographs, diagrams, or any other documents to be digitised quickly and easily, to then be used in a desk top publishing package, art program, or even in your own Basic programs! These useful devices have been available for faster and more expensive micros for some time, but only now is Watford Electronics able to offer the BBC Micro computer.

The HandScan plugs directly into the 1MHz bus on the BBC while a comprehensive set of utilities provided by the sophisticated ROM firmware. The scanner has a resolution of either 100 DPI or 200 DPI when accuracy is essential. Pictures as wide as 4" may be scanned in mode 0 and various types of dithering may be selected to simulate the grey levels of a scanned picture.

All necessary software has been included in the firmware to allow the scanner to read images directly into our Wapping Editor with little more than the click of the mouse. The digitised picture may then be incorporated into your magazine, newsletter, report or any other document.

Beeb HandScan & Firmware £135

Wapping Font Disc

Sixteen Wapping Editor fonts including smaller versions of Oberon and Daisy and two new sizes of the standard font.
Also included are three Mode 0 screens containing giant 'headline' fonts to cut and paste to create extra smooth headlines.
Supplied complete with instructions.

£12





CREDIT CARD 24 HOUR Ansaphone Hot Lines (0923) 50234 or 33383

NEW

Laser Direct
For Archimedes Micro

By using the power of the Archimedes RISC processor, it offers the best of both worlds – print speed up to 5 times faster than typical Laserjet compatibles – uses outline fonts so that any font can be scaled to any size – works with all programs that use RISC OS printer drivers. Ideal for use with Genesis, !Draw, Acorn DTP, Impression, etc. Includes 50 sheet paper tray and a single sheet/ envelope tray. Requires one expansion slot and at least a 2Mbyte Archimedes. A very compact printer, a very low initial cost and very low running costs.

Launch Offer: £949

(For demonstration, call in at our retail shop)

NEW

Beeb PC (BASIC)

Beeb PC Basic is designed for program authors wishing to convert programs so that they will run on IBM personal computers. To convert BBC BASIC programs manually can waste days of valuable time with every occurrence of common statements such as PROC, DEFPROC, TAB, having to be changed. Beeb PC (BASIC) automates many of these changes, and will convert majority of BBC statements that are invalid for IBM BASIC into equivalent acceptable statements. In addition BBC BASIC data files can be converted to IBM BASIC format, with support provided for all BBC data formats:- INTEGER, REAL & STRING.

Price: £38

Beeb DOS 2.2

The BBC and IBM PC's are the most popular micros in the UK. The BBC is firmly established in the education sector and the IBM is the industry standard in the business world. The pools of information and applications held on these computers are immense, yet the means of passing information between them are very limited. Beeb DOS provides a practical method of transferring information between these two micros.

Beeb DOS is a collection of utilities which run on the PC's and enable it to read and write information on BBC discs. You can transfer files between your PC's 360K floppy, high density floppy or hard disc and your BBC discs. In addition Beeb DOS allows you to catalogue, format and compact BBC discs and delete, re-name, lock and unlock BBC files, all on PC's. Each Beeb DOS utility is written in IBM assembler and is run directly from PC or MS-DOS. The Beeb DOS utility can be run from floppy disc, hard disc or RAM drive.

Beeb DOS is supplied on an IBM 5.25", 360K disc complete with a comprehensive operating manual. (Will only work on 360K Disk Drives)

Price: £39

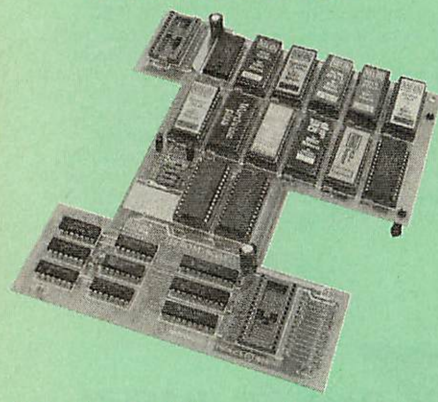
(Please write in for technical literature)

Continued→ → → → → → → → → →

STAFF VACANCIES

Watford Electronics is the leading supplier in the Acorn computer field and has established itself in the PC compatible market with its Aries PC computers. In its eighteen year history, Watford has always kept itself at the forefront of the new technology. Due to our latest expansion, we require staff to man our BBC/Archimedes and PC Technical Departments. Applicants will be required to be familiar with BBC/Archimedes hardware and software, and PC staff will need to be familiar with PC computer hardware. Good rates of pay, excellent prospects. Subsidised company accomodation is available to single persons if required. Telephone Keith Archer or Richard Overfield for interview, or write to us enclosing your CV.

SOLDERLESS SIDEWAYS ROM SOCKET BOARD



The key features of this new, no fuss, easy to install quality product from BBC leaders Watford Electronics are as follows:

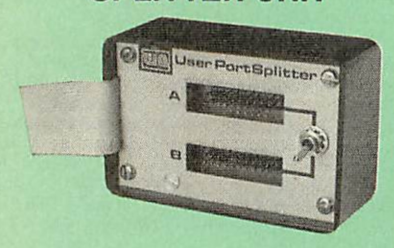
- Increase your BBCs capacity for ROMs from 4 to 16.
- **No soldering required.**
- Very low power consumption.
- Minimal space required.
- Compatible with Torch, DDFS, RAM Card, 2nd Processor, etc.
- Socket 14 takes two 6264 RAM chips.
- Read protect to make RAM "Vanish") allows recovery from ROM crashes.
- Battery backup option for RAM chips.
- Supplied ready to fit with comprehensive instructions.

Price: Only £35
Battery Backup fitted **£39**
Battery Backup only **£3**
16K Sideways RAM **£8.50**
(carriage £3)

- Sideways RAM Utilities Disc for Solderless ROM Board. Includes the options to load and save ROM Images and the facility to use Sideways RAM as Printer Buffer.

Only: £8

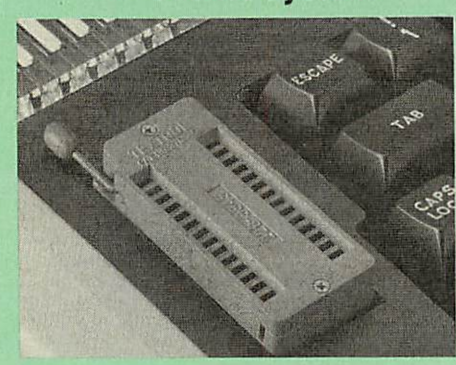
USER PORT SPLITTER UNIT



Gone are the days when you had to plug and unplug devices from the User Port. This extremely useful little device allows two units to be connected to the User Port simultaneously, and select between them simply by toggling a switch. This device is particularly useful for those people using Quest Mouse and the Watford Video Digitiser or any similar combination

Excellent Value at **£22** (carr £2)

Sideways ROM ZIF Socket System



Allows you to change your ROMs quickly and efficiently, without opening the lid. The ZERO INSERTION FORCE (ZIF) socket is located into the ROM Cartridge's position.

- Very simple to install. NO SOLDERING required. The ZIF (Zero Insertion Force) eliminates the possibility of damage to your ROM pins when inserting & extracting.
- The low profile of the socket allows unrestricted access to the Keyboard.
- All data and address lines are correctly terminated to ensure correct operation of suitable ROMs with the BBC micro. We also supply a purpose designed see-through storage container with anti-static lining, allowing you to store up to 12 ROMs, protecting them from mechanical and static damage.
- This versatile hardware solves the problem of running out of socket space. Simply lift the ROM from the ZIF & insert a different one (No pulling or pushing of Cartridges. It is a must for professionals and Hobbyists alike.)
- BBC, B+ and Master compatible.

ONLY **£18** (carr £3)

Low Profile CARTRIDGE SYSTEM

Complete System consists of: Low profile ROM Cartridge, Socket housing, Cable assembly, 5 labels and a library storage rack for the BBC B.

● Complete System	**£11**
● Spare Cartridges	**£2.75**
● Spare Rack	**£1.65**

ROM Cartridges for the BBC Master

Will accept the new larger Piggy Back ROMs like: Interword, Interbase, Quest, Conquest, etc

Twin **£9;** Quad **£14**

16K Disc Ram Module

(16K Sideways RAM Module)

Complete with such features as read and write protection, these new modules from Watford Electronics are ideal for the hobbyist, software developer and ROM collector.
Key points to note about this new addition to the Watford range of products are:

- Write protection (useful in a variety of circumstances)
- Compact construction
- No overheating or overloading problems.
- Free utilities disc supplied
- Can be used as a 16K PRINTER BUFFER.
- Ideal for professional software development.
- Supplied with utilities software disc.

Only: **£29** (carr £2)

Optional Battery back-up fitted **£3**



ARIES CORNER

B-32 Shadow RAM Card

Like the BBC B+, the B32 provides 20k of shadow screen RAM and 12k of sideways RAM. Unlike the B+, the B32 has simple software commands which allow the user to reconfigure the RAM as 16k of shadow RAM and 16k of sideways RAM, or *all 32k as sideways* RAM.

With the B32, the programmer gets up to 28k of RAM available for Basic, Logo, Cobal, Forth, Lisp and BCPL programs in any screen mode. The business user gets extra memory for View, ViewSheet, Wordwise Plus, Interword and many other applications. For advanced applications, the scientific user gets access to a massive 47k of data storage using the Acorn approved ★FX call.

Sideways RAM enables you to load sideways ROM images from disc, allowing you to have a large library of sideways ROMs (subject to the copyright holder's permission) stored on disc. The B32's sideways RAM can also be used to extend any operating system buffer (such as th printer buffer) or to load tape programs into a disc system.

The B32 simply plugs into the 6502 processor socket on you BBC micro – no flying leads to connect and no soldering. Provision of the onboard ROM socket means that the Aries-B32 control ROM does not use up one of your existing ROM sockets.

- Recommended by Computer Concepts for use with their Inter series of ROMs.

Price: **£59** (carr. £3)

Aries B-12 Sideways ROM Board

The B-12 provides a total of twelve sideways ROM sockets (the four in the original machine are replaced by the twelve on the board), all fully accessible by the MOS sideways ROM system. In addition, there are two sockets for sideways RAM, giving up to 16k of RAM using 6264 static RAM chips.

If you do not have a B32 or B20, a small adaptor module (the Aries-B12C) is available at a nominal cost

Price:		
	Aries B-12	£36
	Aries B-12C	£5

ARIES B-488 IEEE-488 INTERFACE UNIT

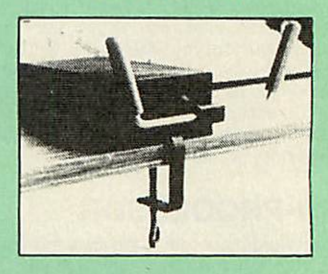
The Aries-B488 is an interface unit to enable the BBC micro to control and monitor IEEE-488 bus systems. The IEEE-488 bus (also known as the 'GPIB or 'HP IB') is the standard method of interconnecting programmable laboratory instruments and control equipment. Using the B488, up to 15 devices may be connected in a single high-speed data network.

£238 (Carr £3)

VOLTMACE JOYSTICKS

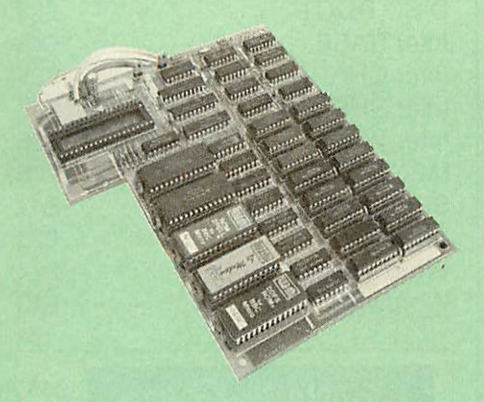
Delta 3B Single Joystick	£10
Delta 3B Twin Joysticks	£15
Delta 3C Joystick for Compact	£10
Delta 14B Single Joystick	£11
Delta 14B/1 Adaptor Module	£12
Transfer Software Disc-Tape	£7
Delta-Cat A mouse eliminator Joystick for the Archimedes	£24

Delta Base B



Analogue aircraft style yoke Joystick to run in the analogue port of the BBC B & Master 128 **£25**

ROM/RAM CARD



Watford Electronics announced the first ever commercial ROM board for the BBC micro, the Watford Electronics 13 ROM Socket Board 7 years ago. Following the success of this board, we have designed what probably represents the ultimate in expansion boards, the new Watford Electronics ROM/RAM board. This highly versatile and sophisticated board represents the latest in "2nd generation" sideways ROM technology for the BBC micro, designed to satisfy the serious BBC user.

- NO SOLDERING required to fit the board.
- NO User Port corruption (avoids problems with the mouse, modems, Eprom Programmers, etc.)
- *Fully buffered for peace of mind.*
- Compatible with BBC micros (not BBC+ or Master).
- Total number of ROMs increased from 4 to 8.
- Up to 8 banks of sideways RAM (dynamic).
- Option for 16k of battery backed CMOS RAM (CMOS RAM needs one ROM socket).
- Software Write protect for ALL RAM.
- Read protect for CMOS RAM (ALLEVIATES crashes during ROM development).
- Separate RAM write register (&FF30 to &FF3F).
- Automatic write to currently selected RAM socket for convenience.
- FREE utilities disc packed with software.
- Compatible with our DDFS board, 32k RAM Card, Delta Card, sideways ZIF, etc.
- Large printer buffer.
- UNIQUE fully implemented RAM FILING SYSTEM (similar to the popular Watford DFS).
- ROM to RAM load and save facilities.

The SFS (Silicon Filing System) can utilise up to the full 128k of RAM (with the SFS in any paged RAM) as a SILICON DISC. This behaves as a disc drive, with all the normal Watford DFS features (including OSWORD &7F for ROMSPELL, etc.) to provide an environment that looks like a disc but loads and saves MUCH faster.

The ROM-RAM Board plugs into the 6502 CPU socket. This leaves free all the existing ROM sockets, which can still be used normally.

Any ROM that can be plugged into the BBC micro's own ROM sockets may be used in the ROM-RAM Board.

The ROM-RAM Board is supplied with all ordered options fitted as standard. Upgrade kits (with full instructions) are available for all of the options, for later.

INTRODUCTORY PRICES:

- ROM/RAM card with 32k dynamic RAM £48
- ROM/RAM card with 64k dynamic RAM £65
- ROM/RAM card with a massive 128k dynamic RAM £109

(carriage on ROM-RAM Card £3)

OPTIONAL EXTRAS:

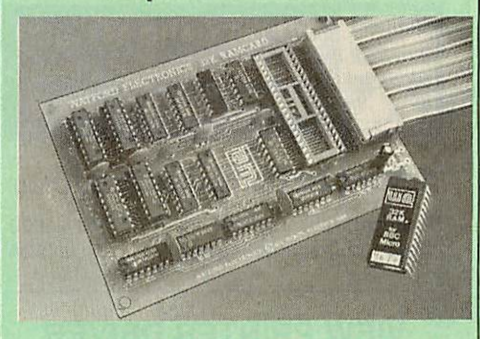
- 16k plug-in Static RAM kit £9
- 16k Dynamic RAM for Upgrade £13
- Battery backup £3
- Read and Write protect switches ....£2 each

Complete ROM-RAM board All options installed £115

P.S.

IS your existing ROM Board overflowing with ROMs? Do you need more Sideways RAM? Is your Board unreliable? Then upgrade to Watford, ROM/RAM Board and pay £5 less.

32K SHADOW RAM-Printer Buffer Expansion Board



A MUST FOR WORD PROCESSING

Watford Electronics now brings you the latest state-of-the-art MEMORY EXPANSION BOARD for your BBC microcomputer. Don't throw away your BBC B for a BBC B Plus or BBC Master. Just plug the ribbon cable into the 6502 processor socket, and fit the compact board inside the computer. Immediately you will gain not 16k or even 20k, but a massive 32k of extra RAM!!!

- IMPROVE your WORD PROCESSING system, whether disc or cassette based. Don't wait for a slow printer – type in text while printing. TWO JOBS DONE SIMULTANEOUSLY and £100+ saved on a printer buffer.
- "VIEW" Wordprocessor users can now type in letters in 80 columns and have up to 28,000 bytes free – 5 times as much as normal.
- In WORDWISE (or WORDWISE-PLUS), preview in 80 columns with the full 24k of text in memory. This product is recommended as an ideal complement by Computer Concepts.
- Combine GOOD GRAPHICS and LONG PROGRAMS. Use the top 20k of the expansion RAM as the screen display memory, leaving all the standard BBC RAM free for programs. Benefit from MODE 0/1/2 graphics and 28k of program space.
- Use the FULL 32k or the bottom 12k of the expansion RAM as a PRINTER buffer for PARALLEL or SERIAL printers, sound channels, RS432 etc. Print large text files while running long graphics programs, and have all your buffer options available as well (*FX15,21,138, 145,ADVAL etc). Please note only a 12k printer buffer can be used with Wordwise or Wordwise-Plus, due to the way they are written.
- Unique facility to turn ROMs off and on again. Unlike all other ROM managers, this feature does not use 'unofficial' memory. Two bytes of normally user-inaccessible memory on the RAM card are used to ensure ROMs are disabled WHERE OTHER ROMS FAIL.

Only £59 (carr £3)
(Price includes a comprehensive manual and the ROM)

Acorn Speech Synthesizer package complete, for the BBC B Microcomputer
Special Offer £18

Watford Electronics are:

- Acorn Qualified Dealer & Econet Referral Centre
- ARIES PC Dealer/Distributor
- Cambridge Computer Dealer
- Epson Silver Centre
- EIZO Monitor Dealer
- Microvitec Appointed Dealer
- NEC Appointed Dealer
- Panasonic Premier Dealer
- Roland Plotter Official Dealer
- Star Printer Sub Distributor
- Taxan Appointed Monitor Dealer
- 3M Media Premier Distributor

BBC SOFTWARE'S Popular Educational Software

- Maths with a Story 1 (Disc). 4 primary level maths programs **£11.25**
- Maths with a Story 2 (Disc). 4 further maths programs. **£11.25**
- Picture Craft (Disc) 6-14 age group. Pack consists of flexible geometrical design & colouring programs. **£17.00**
- BONDING: Science (Disc) O-Level Chemistry program. **£20.00**
- ELECTROMAGNETIC SPECTRUM (8 Discs) O-Level program. **£20.00**
- ELECTRONICS IN ACTION (Disc) O-Level program. **£19.95**
- NEWTON & THE SPACE SHUTTLE (Disc) O-Level program. **£20.00**
- ECOLOGY (Disc) O-Level program. **£20.00**
- POLYMERS (Disc) O-Level program. **£20.00**
- Classification & Periodic Table O-Level. The suite is supplied with its own database of chemical elements which can be classified according to your own rule. **£20.00**
- FOOD & POPULATION (Disc) O-Level program. **£20.00**
- MICROTECHNOLOGY (Cassette) O-Level program. **£11.25**
- DEUTSCH DIREKT! (Disc & Audio Cassette) **£19.95**
- Modem Master (Disc) **£11.25**
- ADVANCED TELETEXT SYSTEM **£8.65**
- PERIOD TABLE SOFTWARE **£20.00**
- Astronomy – Primary (Disc) **£12.00**
- Computers at Work – Primary **£17.35**
- Introducing Geography 11-17 years **£17.50**
- Electric Fields 6-14 years **£11.25**
- Black Queen Contract Bridge **£13.00**
- Espana Viva – 3 Discs **£19.95**
- WHITE KNIGHT Chess game **£16.00**

Educational Software

FUN SCHOOL 2 – Red:
Under 6 yrs – 8 programs on Discs, Shape Snap, Find the Mole, Teddy Count, Write a letter, Colour Train, Pick a Letter, Spell a Word & Teddy Bears Picnic. **£12.00**

FUN SCHOOL 2 – Green:
6-8 yrs – Eight programs on Disc, Number Train, Shopping, Maths Maze, Treasure Hunt, Bounce, Packing Caterpillar, 3 Number jump **£12.25**

FUN SCHOOL 2 – Blue:
Over 8 yrs – Eight programs on Disc, Build a Bridge, Passage of Guardians, Unicorn, Logic Doors, Souvenirs, Code Boxes, Mystery Machine & Escape. **£12.50**

- PUNCMAN Learning punctuation
  - Puncman 1 & 2 for 7 – 13 years **£15**
  - Puncman 3 & 4 for 8 – 14 years **£15**
  - Puncman 5 & 6 for 8 – 15 years **£15**
- Yes Chancellor – A chance to take over number 11 at Downing Street. 12 years+ **£18**
- Letters & Pictures – Introduces phonic skills to Infants 6-8 years **£15**
- Numbers & Pictures – Early number learning is a great fun (4-6 years) **£15**
- Note Invaders – Budding musicians can learn the notes on the Clef with this elegant game 3 programs (7 to Adults) **£15**
- Maps & landscapes No. 1 (9-14 years) **£18**
- Help Your Child learn Basic Map work No. 2 (9-14 years) **£18**
- Pirate – Educational Adventure (8-14 years) **£15**
- Spelling Week by Week (6-14 years) **£18**

Archimedes Software

- BUMPER DISC **£14**
- Bumper Disc 2 **£14**
- Fun School 2A Red (up to 6 years) **£14**
- Fun School 2A Green (6-8 years) **£14**
- Fun School 2A Blue **£14**

Continued→ → → → → → → → →

VIEW 3.0 ROM	£45
VIEW PROFESSIONAL	£50
VIEWSHEET (Acornsoft)	£36
VIEWSTORE	£36
VIEWSPELL with 80 track disc	£25
VIEWPLOT Disc (Please specify for Master 128 or Compact)	£20
VIEW-INDEX	£12
OVERVIEW packs 1 & 2	£65
HI-VIEW	£38

Watford's own Sophisticated VIEW PRINTER DRIVERS

Epson FX80 & Kaga KP (Disc)	£8
Juki & Brother HR15 (Disc)	£8

OFFICE MASTER



CASHBOOK – A complete "Stand Alone" accounting software package for the cash based sole trader/partnership business. It is designed to replace your existing cashbook system and will provide you with a computerised system complete to trial balance.

FINAL ACCOUNTS – Will take data prepared by the Cashbook module and produce a complete set of accounts as following: Trial Balance with inbuilt rounding routine; Notes to the accounts; VAT Summary; Profit & Loss A/C; Balance Sheet.

MAILIST – A very versatile program. Enables you to keep records of names and addresses and then print, examine, sort and find them, all with special selection techniques.

EASILEDGER – A management aid software tool designed to run alongside an existing accounting system. Essentially a Debit/Credit ledger system which can handle sales, purchase and nominal ledger routines to provide instant management information.

INVOICES & STATEMENTS – Greatly reduces the time and cost of preparing Invoices and Statements by storing essential information like customer names, addresses and account numbers. Has VAT routines and footer messages facility.

STOCK CONTROL – Allows you to enter stock received, stock out, summary of stock items and current holdings together with details of total cost, total stock to minimum level, units in stock ordering, quantity and supplier detail.

All this for only **£21** (Disc)

OFFICE MATE



- DATABASE
- BEEBCALC SPREADSHEET
- BEEBPLOT GRAPHICS

DATABASE – Set up a computerised card index system with powerful search facilities.

SPREADSHEET – Offers many calculation and editing features

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OFFICE MATE Only £10 (Disc)

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DISC Version for BBC B & B+	£14.00
DISC Version for BBC Master	£16.00
DISC Version for the Compact	£18.00

(When ordering please specify for which Micro & 40 or 80 track Disc)

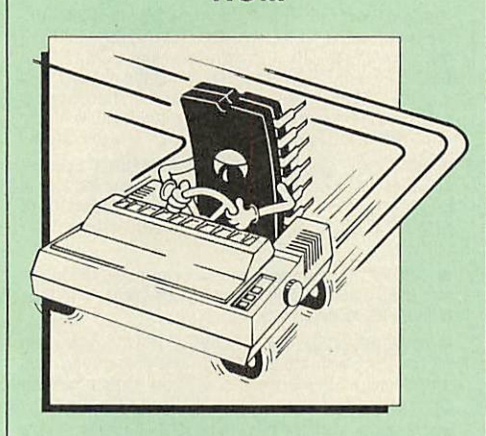


CREDIT CARD 24 HOUR Ansaphone Hot Lines (0923) 50234 or 33383

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Advanced Disc Toolkit	£28
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VIEW PRINTER DRIVER ROM



View is a powerful word processor, but until now has seriously lacked in terms of printer support. With the launch of our Printer Driver ROM, which includes an extremely powerful and easy to use Printer Driver Generator, View users can find themselves in the realms of advanced word processing at only a small outlay.

The VPD extends View's printer command with a series of mnemonic commands. All standard highlight sequences are also supported. A large range of printers are supported by drivers contained within the ROM (the drivers can be downloaded and customised). Printers supported include: Epson's MX, RX, FX, LX, JX80 range, HI80, KP810/910, PW1080, JP101, HR15, M1009, GLP, Panasonic KX-P1081/2, JUKI 6100, etc.

Other printers are readily supported by defining a Printer Driver using the built-in Printer Driver Generator. The features mentioned below are available to both the built in Printer Drivers and user defined drivers (assuming the printer supports the features).

NLQ control, Underline, Bold, Proportional Spacing, Microspacing, Italic, Superscript, Subscript, Condensed, Enlarged, Double Strike, Set lines per inch numerically (e.g. LPI 6), Set characters per inch numerically (e.g. CPI 5), Select printer font, Select printer ribbon colour, Translation sequences, Emulation of BBC Character Set, Simple numeric expressions for certain operations, Full printer setup, Send control codes, Print prompt on screen, Redifinable Pad character, Pause for key press, Prompt to change daisywheel, and Execute ★ command when printing.

Other features include a very powerful on-screen preview, with bold, italic, underline, super/subscript, enlarged highlights, and a special printer driver to allow memory-based text to be previewed by View 1.4. Of course, View 1.4, 2.1 and 3.0 are all supported, as is Shadow RAM and 6502 Second Processors. The BBC B series and Master series of micros are supported. A comprehensive manual is supplied. All in all, a very professional product for the discerning user who wants power at their finger tips.

Price: Only £33

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Wordwise plus £40

We are giving away absolutely **FREE**, the superb Word-Aid ROM worth £24, with every WORDWISE PLUS package bought from us.

Word-Aid

The most comprehensive utilities ROM for Wordwise-Plus

Extend the power of your Wordwise Plus word processor with this most advanced ROM from Watford. By utilising the powerful Wordwise Plus programming language, WordAid provides a whole host of extra features, all accessed via a special new menu option. This ROM has been personally approved by Mr Charles Moir, the author of WORDWISE PLUS.

- Alphabetical sorting of names and addresses.
- Text transfer options.
- Chapter marker.
- Epson printer codes function key option.
- Search and display in preview mode.
- Embedded command removal.
- Print Multiple copies of a document.
- Multiple file options for print and preview.
- Address finder.
- Label printer.
- Mail-merger.
- Number/delete/renumber.
- Clear test-segment area.
- BBC B, B+ and Master compatible.

Only **£24**

(N.B. Word Aid requires a Disc interface in your Micro)

BOOK

The Complete Mouse User Guide to BBC Micro

This manual has been written to reveal the secrets of the mouse. It explains all the principles required by the hardware and associated software, and also example listings for inclusion into custom programs. The manual first details the basic principles of the mouse and a simple program which uses these principles. This information should be adequate for most applications. However, it is possible to improve the performance of the mouse by expanding on the principles already used in the software. This is again fully explained and an example program given.

It is possible to gain a full understanding of the mouse from this manual. For those not interested in exactly how the mouse functions, complete example programs are also included. These may be typed directly into the micro, without the need for any understanding of the hardware or software involved, enabling the mouse to be used for custom applications.

Price £5.95 (No VAT)

Example programs on Disc £4.95

BOOKS (No VAT on Books)

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THE COMPLETE BBC COMPUTER USER HANDBOOK

"Why has no-one written a book like this before? It's long overdue".

If you own a BBC-B, BBC B+, Electron, Master 128, Master Compact or Archimedes then this book is for you. It shows you how to get the most from your computer, and how to make the computer work for you. Although some sections are machine specific, most of the information, programs, hints and good solid experience are for the whole range of BBC machines. The general style and level means that both beginner and expert will feel satisfied with the quality and quantity of the material.

GENERAL – Uses and abuses of computers.

HARDWARE – How to design your own work station. Hardware additions (disc drives, ROMs, printers, 2nd processors, etc). DIY alterations.

HARDWARE RUNNING BBC-BASIC – All BBC machines are described with their differences. Compatibility between the various BBC machines. Networks. The Archimedes and its advantages.

GETTING ORGANISED – So that you keep track of your programs and control of your software. Setting up for easier programming sessions.

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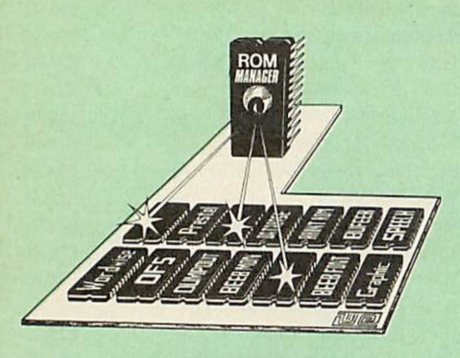
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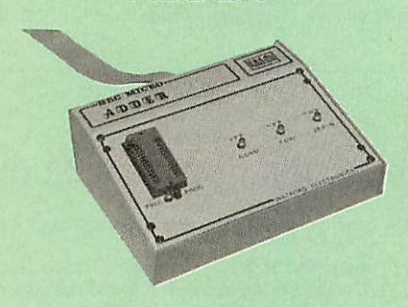
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Take control of your Sideways ROMs with ROM Manager. This powerful utility ROM gives you power over your sideways ROMs . Disable whole ROMs, send commands directly to named ROMs and many other powerful facilities.
"Provides comprehensive management of all your installed ROMs". (BEEBUG November '84.)

ONLY £20

ADDER



The only low cost EPROM Programmer for the BBC Micro that will program both the standard 21V and the new 12V5, 27128 EPROMS.
The Adder unit connects to the User Port and draws its power from there too. The EPROM is mounted in a top quality ZIF socket. There are no switches or controls as Adder is entirely software controlled.
The Adder software provides sophisticated facilities for programming EPROMs from a RAM image produced by loading disc files. The software is menu driven and designed for ease of use.

Features:

- Two ultra fast programming algorithms or standard slow algorithm.
- Supports standard 21V programming and newer 12.5 volt EPROMs. (Software switched).
- The RAM image to be programmed can be built up in many ways. Sections of image can be loaded separately. Part programming. Read EPROM. Edit data in memory.
- Automatic processing to handle a list of files to program into the EPROM.
- Automatic disc buffering to allow programming of 32K 27256 devices from a 32K file without extra effort.
- Verification gives detailed error list and checksums are maintained. There is also a blank check facility.
- Works with all standard filing systems. Generates header code for RFS ROMs to allow Basic programs etc. to be stored in EPROM. More than one file per ROM permitted.
- Programs the following EPROMs: 2516, 2716, 2532, 2732, 2764, 27128, & 27256.

£65 (£5 Carr)

TEX EPROM ERASERS

EPROMs need careful treatment if they are to survive their expected lifetime. Over erasure of EPROMs very rapidly turns them into ROMs!
The TEX erasers operate following the manufacturers specifications to give the maximum possible working life by not erasing too fast. We use these erasers for all our own erasing work.

- **ERASER EB** – Standard version erases up to 16 chips. **£32**(carr £3)
- **ERASER GT** – Deluxe version erases up to 18 chips. Has automatic safety cut-off to switch off the UV lamp when opened. **£34** (carr £3)
- Spare UV tubes. **£12**

Servisol Foam Cleaner

This 415Ml, king size multi-purpose foam cleaner spray is ideal for cleaning the Keyboard, Monitor, Disc Drive and your computer furniture surfaces. Simply spray on the surface to clean and wipe off with a clean cloth.

£2.50

Antistatic Aerosol Spray

Ideal for cleaning and preventing static build-up on TV/Monitor Screens.

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Aerosol Dust Spray

This simple to use aerosol spray is ideal for removing Dust and Dirt deposits from the Keyboards and similar inaccessible places. **£3**

SPARES for BBC Micro

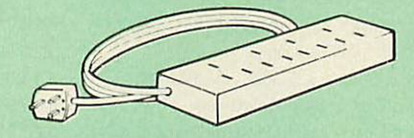
BBC Keyboard	£46	Speaker	£3
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Surge Protector Plug

Fitted in place of your normal mains plug, this device protects your equipment (and data from corruption), against mains high voltage translent spikes/surges caused by lightening or thermostats switching.

Protection for only **£8.50**

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4 way top quality mains trailing sockets. Supplied wired up with mains plug ready for use. Can be screwed to floor or wall if required. Very useful for tidying up all the mains leads from your peripherals.

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Aries Spike Cleaner Unit

A 4 way mains distribution unit as above with a built-in Surge Arrester, providing protection for your complete Computer/Hi-Fi System

£13.50 (carr. £1.50)

ROM Extraction Tool

This extremely useful tool allows you trouble free chip insertion and removal from your computer by distributing the removal force over the whole body of any 24 or 28 pin chip. **£2**

Metal Chip Extractor **£3**

28pin DIL HEADER PLUG

SOLDER type **£1.50** IDC CRIMP type **£1.95**

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Increase the speed of your Disc Drives by soldering this switch to your BBC B or B+ keyboard

Only **£1.00**

28 pin ZIF SOCKET (Textool) **£6.95**

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(All ready made and tested)

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DISC DRIVE POWER LEADS

Supply from BBC power supply to standard Disc Drive Connection: Single **£3.00**; Dual **£3.75**

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BBC to Disc Drives Ribbon Cable
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Convert two single Disc Drives into one Dual Drive with this simple external unit (Suitable for Disc Drives with PSU. For Disc Drives without PSU, you will also require Watford Power Duck, see below).

£14

Watford POWER DUCK **£8**

CHIP SHOP

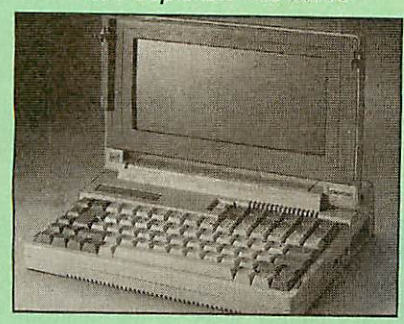
1 Meg DIL D-RAM	£8.50
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65C12	£9.00
6512A	£10.00
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6522A	£5.00
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68B54	£7.50
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74LS04	25p
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74LS244	£1.00
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GXR-B	£21
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ARIES P20-HD PC Portable

Full Desktop PC Power For People On The Move



Imagine an IBM PC compatible laptop that can fit inside your briefcase (with room left over), so light (just over 7 pounds) that it is easy to carry wherever you go, and a choice between AC and rechargeable battery power, so you could use it any-where. The Aries portable has made your dream a reality with the world's most powerful compact Laptop. Also it is the FIRST COMPACT PC PORTABLE, incorporating a HARD DISK at under a £1,000.

The Aries portable has an energy-efficient 80C88 micro-processor that runs at 10MHz, a built-in high-capacity high speed, 20MB Hard disk drive, 1MB RAM, an advance LCD display, and a standard full-size keyboard with comfortable tactile feedback. The Aries Portable also has a full complement of six built-in ports (two RS232, one printer, one external FDD, one RGB monitor, one mouse), so you can add on extras wherever you settle down. All of this in a case so compact that it can easily fit inside your briefcase.

In his independent review (Computer Shopper, May 1990), the reviewer writes, – "Overall, the single most outstanding feature has to be the price tag. A notebook PC, with a hard disc selling for below £1,000 has no competition at the moment. If you have a small briefcase, weak arms or just like the concept of a truly portable computer then this is your man".

Just read the specification . . .

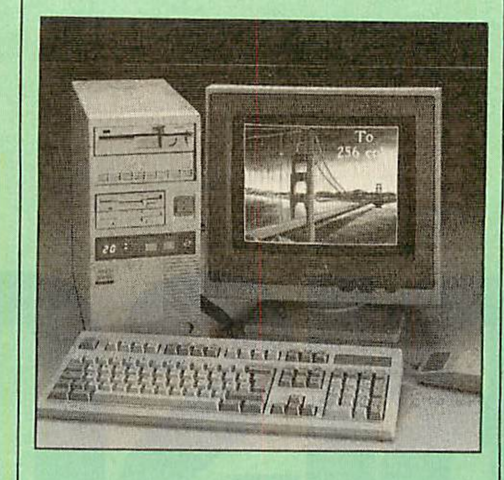
- **Processor:** 80C86 running at 10MHz Real time clock/calendar
- **Memory:** 1MB RAM (640K,384KbLIM/EMS)
- **Drive:** Built-in 2.5" 20MB Hard Disk Access Speed 28ms (optional external 3.5" 1.44MB)
- **Display:** EL backlit transflective supertwist LCD display, 80 characters x 25 lines, 640 x 200 bit-mapped graphics IBM CGA compatible
- **Stnd Interface** Parallel Printer Port. Two RS232C Serial Ports External disk drive port. CGA Colour monitor port External keyboard port or PS/2 mouse port
- **Stnd.Accessories:** AC mains adaptor/ batt. charger. External FDD Convertor Battery pack
- **Dimensions:** 12"W x 2.4"H x 8.7"D
- **Weight:** Just over 7lb (incl. H'Disk/Batt.)
- **Power:** Internal removable Ni-cad batt. AC adaptor, 12V DC. Low battery indicator. Battery charge indicator
- **Bundled Software:** MS-DOS 3.3/GW-Basic Watford Drive package (allows data to be transferred with other PC Compatibles via parallel port. PC Organiser Diary, Calendar, WP

Introductory Offer

- 20 Hard Disc Version **£999**
- 3.5" 1.44MB Floppy Version **£649**

- External 3.5" Disc Drive 720K1M44 **£89**
- External 5.25" Disc Drive 1M2 **£95**

ARIES PC 386-SX



The Aries PC 386-SX combines many of the powerful features of the 386 system with the frugality of a price tag more at home on a 286 system. With 8/16MHz CPU, this system provides virtually full 386 performance, including the more convenient scheme of memory control that allows easy configuration of expansion RAM as EMS for DOS application.

Features:

- 80386-SX CPU with optional 80287/80387 Maths Co-Processor
- 8/16 MHz selectable speed
- Legal Bios with built-in Setup routine
- For OS/2 and XENIX
- On-Board EMS

Specifications:

- 1MB RAM on-Board expandable to 16Meg
- 1 x 5.25" – 1.2Meg Drive fitted
- 1 x 3.5" – 1.44Meg Drive fitted
- 40Meg 28mS Hard Disc Drive fitted
- HDD/FDD Controller Card
- 102 Key Keyboard
- Case with Keylock
- Eight expansion slots
- Two Serial and Parallel Ports
- Logitech mouse
- MS-DOS 3.3 & GW BASIC
- 12 months On-Site maintenance
- FREE £300 worth of Software/Hardware

Special prices:

- System 1 – As above plus a 14" High Resolution Flat Screen monitor **£1299**
- System 2 – As above plus a 14" High Resolution EGA Monitor/Card **£1599**
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For all Archimedes and A3000 owners, DAVE ACTON has compiled

RISC REVUE

£20 POINTER POINT

Our starter this month is a little Risc OS application that demonstrates the finer points of the pointer.

It comes from Joe Abley of Bedford school who duly gets £20 for his coding efforts.

We've covered the subject of the pointer and how to change its shape in this column before. Because it is often useful to use a pointer of your own design within your own desktop window, there is an established way in which to do this and a 'legal' Risc OS call to do the work.

Joe's application consists of an empty window which can be dragged and scaled in the usual manner. Whenever the pointer moves over it, though, it changes into one of Joe's own design.

Incorporating the necessary code in your own application should be easy enough.

To try the demo, first create a directory called !PtrDemo. Then enter listing 1 from the yellow pages and save it in !PtrDemo as !RunImage.

Now run listing 2 – this creates the sprite and template files used by !RunImage.

Finally you will need to create an obey file called !Run and put this in !PtrDemo also. The most straightforward way to do this is by using *!Edit*.

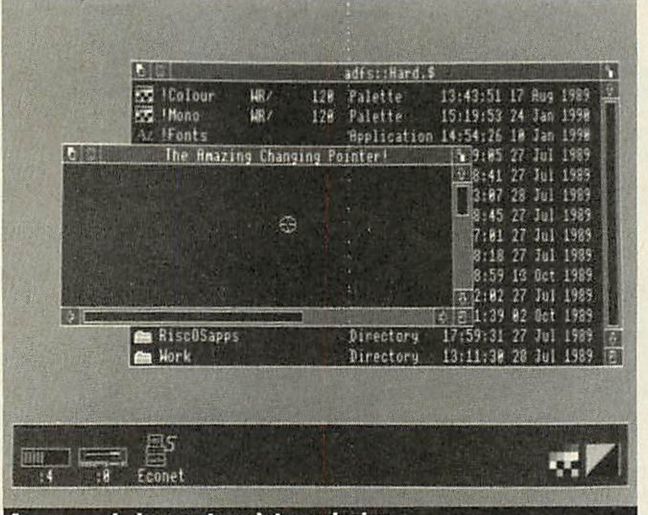
The contents of !Run should be as follows:

```
Set ptrdemo$dir <Obey$Dir>
WimpSlot -min 32k -max 32k
IconSprites <Obey$Dir>.!Sprites
Run <ptrdemo$Dir>.!RunImage
```

Now try the demo by double clicking on !PtrDemo. A window should appear.

When the pointer moves over it, a cross-hair should replace the standard arrow.

The old OS_Word and OS_Byte calls that used to be the means of redefining the pointer shape have been superseded by Wimp_SpriteOp with R0=36. (Wimp_SpriteOp is the Wimp version of the more familiar OS_SpriteOp call. It is used so that the pointer to the Wimp's sprite area need not be specified.) This official call redefines the pointer according to a sprite definition and adjusts the scale and colours as necessary.



An open window on to pointer redesign

Pointer sprites have names in the form ptr_xxxx and the default pointer shape is called, unsurprisingly, ptr_default.

As you will recall if you tried the pointer editor from way back in the days of Arc Agora, there are four pointer shapes available to the user at any one time. Risc OS demands that when changing the pointer shape, you should do it to pointer 2 since pointer 1 is used by the Wimp for the standard arrow and 3 and 4 are used by the Hourglass module.

So that an application knows when the pointer is on its territory, there are two reason codes returned by Wimp_Poll: 4 (pointer leaving window) and 5 (pointer entering window).

So, to be legal, upon receipt of reason code 5 the application should issue the appropriate "Wimp_SpriteOp",36 call and after reason code 4 should restore the pointer. The *Programmer's Reference Manual* recommends a simple *POINTER command for this purpose.

Joe's program should be easy enough to follow. At the start, the Wimp is informed of the new task and the window is defined using template calls. The main loop contains a call to *POINTER and, as always, a CASE statement is used to pick out the various events and requests as they occur.

PROCdefault_pointer resets the pointer shape to the standard arrow and PROCmy_pointer changes it to the cross-hair.

Note that the sprite ptr_cross has already been included in the common sprite pool by the *IconSprites command in the !Run file.

One awkward problem with changing the pointer comes when the screen mode is altered. After any mode change, the pointer is reset to the default shape, so applications should maintain a flag reflecting whether or not they 'own' the pointer.

If at the time of a mode change an application was 'in possession' it should redefine the shape as required.

The flag in the demonstration is called *IconSprites. The mode change is recognised by the application because a message &400C1 is received from Wimp_Poll.

£10 HIGH POWERED

Just a little something here for fans of large numbers. We had a set of mathematical items sent to us by A F Reysenbach of Amsterdam and listing 3 on the yellow pages is one of them.

It's a program to calculate powers of numbers – simply enter a number and the power to which it is to be raised. Memory permitting, the answer will be displayed in all its multi-precision glory.

Figure 1 shows an example of what the program can do – three raised to the thousandth power, the answer being a 478 digit number.

The program operates in a simple way using an array. Each digit in the answer is represented by an element of the array and a simple add-with-carry system is used in PROCraise to do the calculation.

Mr Reysenbach freely admits that he doesn't know why the small additional fraction in line 150 is needed!

The process, being in Basic,

his regular bounty of advice, hints, tips and programming snippets

takes a little while. On my old 440, it takes 9.23 seconds to calculate 3^{1000}. On an A3000 the pace will be noticeably brisker.

Out of interest I compiled the program with Silicon Vision's RiscBasic and the time went down to 2.29 seconds.

Similar speed gains were possible with Dabs Press's ABC.

1322070819480806636890455259752144365965
4220327521481676649203682268285973467048
9954077831385060806196390977769687258235
5950954582100618911865342725257953674027
6202251983208038780147742289648412743904
0011758861804112894781562309443806156617
3054086574490506178125480344405547054397
0388958174653682549161362208302685637785
8229022841639830788789691855640408489893
76093732421718463599386955516765018940588
1090604260896714388641028143503856487471
65832010614366132173102768902855220001

Three to the thousandth – as much precision as you'll need

£15 LIFE IN THE FAST LANE

I'm always a little cautious about carrying another version of the *Game of Life* in this column, despite the old chestnut's seemingly ageless qualities. However, this speedy little version from Andrew Smith of Kidderminster certainly deserves a look and earns him £15 too. You'll find it as listing 4 on the yellow pages.

Andrew's program is an Arc version of the speedy eight-bit *Life* by Phil Bender, carried in the May 1990 issue (page 73). The mouse is used to move the pointer around the display.

Use the left button (Select) to place a cell, the right button (Adjust) to remove a cell and press the middle button (Menu) to start the process of evolution. Press C to clear the grid and R for a random pattern (followed by RETURN when you're ready to start).

When evolving, press keys 1 to 3 to set the speed, P and O to pause and resume respectively, and Q to quit.

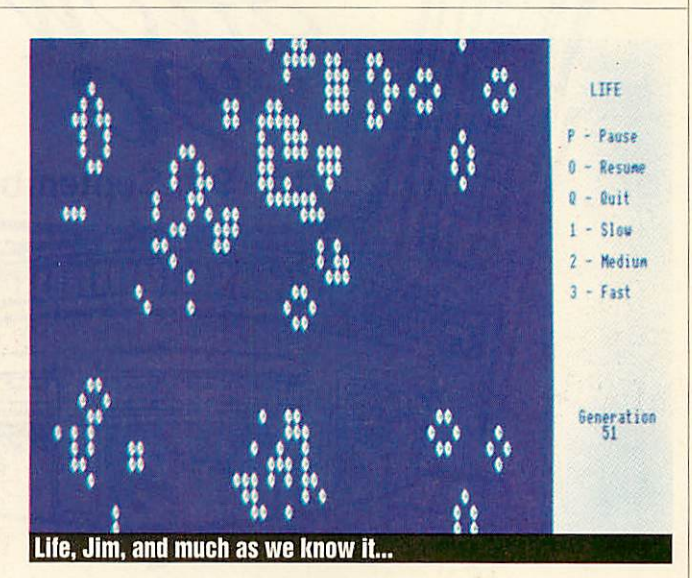
To try out the program, use Phil's original test pattern. Place a horizontal line of five cells on a blank grid. Move down a line and put a cell under the left hand end. Move down another row and put one under the right hand end. Then click Menu.

After 1,200 generations the swirling cell patterns will settle into a stable state. This took 70 seconds in fast mode on the eight-bit version.

Andrew's Arm code adaptation takes a mere 20 seconds on a 310 machine.

One problem with such a fast implementation of *Life* is that the screen is only refreshed at 25 fields (or rather, 50 half-fields) a second. So, with an evolution rate of 60 or more generations per second, intermediate stages will inevitably be lost to the eye!

If you're feeling adventurous though, you might like to write a version of *Life* with the largest grid possible that still permits an evolution speed of 25 generations per second.



Life, Jim, and much as we know it...

£5 ERROR UPDATE

Well, we did have some problems with the Beeb-to-Arc screen converter by Gordon Jefferyes, carried in the July issue.

In his 10-line program we managed to insert five errors! Many apologies to Gordon and all. A corrected version is given on the yellow pages as listing 5. Remember to alter lines 10 and 30 as necessary.

Another goof you may have spotted was the ID$ in the piece 'Back to Basics'. This should have been MID$ and was not a keyword from some new psychological programming language.

Philip Draper of Elstree has noticed some problems with the screen saver we carried in the April issue.

Apparently some problems may occur if a multi-sync screen is blanked for anything more than a few seconds.

If anyone has a cure, for this, or a screen saver that works in a different manner, why not send it in to us?

Michael Ellis of Kingston upon Thames has suggested an improvement for the *!Scrunge* utility that we carried in the March issue.

As you may remember, scrunged files are all of type DATA. Michael suggests using an 'unused' filetype for scrunged files.

I should point out that official permission should be sought from Acorn when using particular filetype numbers. If not, there will inevitably be clashes of interest in the future.

However, if you'd like to try Michael's alteration in the meantime, here's what you do:

- Insert the following line into the !Run file (after *SET Scrunge$Dir):

```
Set File$Type_B00 Scrunge
```

- Create a new icon in !Sprites called file_b00 using *!Paint*. This should be the same size as other filetype icons.
- Add/modify the following lines in !RunImage:

```
1725 OSCLI ("SETTYPE "+scrungefile$+" Scrunge")
3650 PROCsetsaveicon ("file_b00")
```

- Finally, change the filetype of existing scrunged files using *SETTYPE.

I have also a report of a problem with *!Scrunge* (which I am currently investigating) and a couple of suggestions for improvements. Watch this space for future updates.

SEND THEM IN...

Submit your programs, ideas, hints and tips to: Risc Revue, *BBC Acorn User*, Redwood Publishing, 20-26 Brunswick Place, London N1 6DJ.

If the limitless fame and prestige weren't enough, you could even earn yourself a quid or two, so get coding – why not?

BAU STYLE

Just a quick word on a couple of points of style.

We prefer, wherever possible, for Basic variables to be in lower case. This makes for tidier listings and is consistent with the rest of the magazine.

Also, Assembler listings should contain few (if any) comments.

We prefer to describe how the program works in the text and for labels to be descriptive.

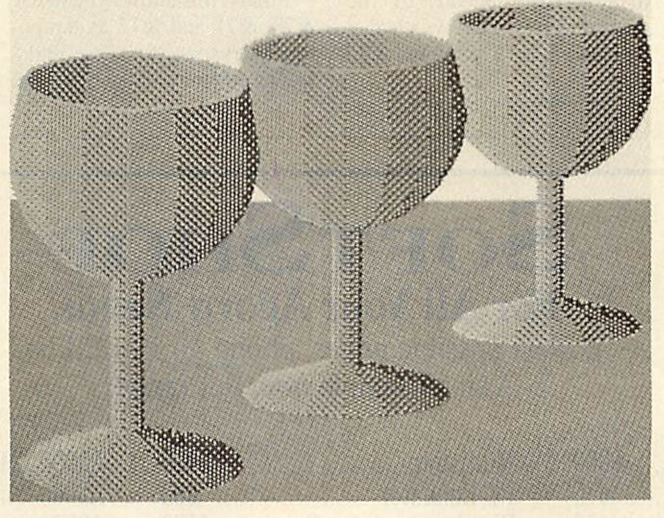
EIGHT BITS

£5 3-D SOLIDS



Malcolm Dolman of Holywell has read with interest Rob Miller's article 'Quick Turnaround' in the May 1990 issue of *BAU*, and feels the results on eight-bit machines could be improved on. Malcolm has provided two goblet-drawing programs based on Rob Miller's original algorithm. The first one draws a single goblet in mode 0 and works on the standard BBC. The second uses the extended colour fill routines (VDU 23,2,n1...n8) of the Master 128 operating system to maximum effect, and as such will only work on the Master and Compact (and of course the Arc!).

The first program is similar to Rob Miller's original except that it uses colour fill patterns, and works in mode 0 for maximum resolution. It would also run tolerably well in mode 4. The second program draws three goblets in mode 1 using Master extended colour fills. This time they are a bit more complex, as the ECF system is slightly strange in multi-colour modes.



£5 E ATTRIBUTE TIP

Here is an excellent tip, especially for teachers, from David Arnold at Warleigh School in Avon. When you use ADFS on the Master, you may find that you accidentally give the E attribute to a file, for example if you meant to type *ACCESS WR but hit the key next door! As you will know if you have ever done this, you can't 'undo' an E attribute. Once the E attribute is set, you cannot LOAD, CHAIN, TYPE or do anything except *RUN the file, and alarm and despondency can easily set in. You can remove the attribute with a special file, but what if this is not to hand?

If you have an Archimedes you can easily solve the problem. The Arc will read the Master's ADFS discs but does not use the E attribute at all. Pop the disc into the Archimedes, and type *ACCESS <filename> WR and then return the disc to the Master. The file will now be readable and writeable to.

I have often wondered why Acorn used this system. Any files set to E can only be *RUN, so combined with an *FX200,3 command at the start of the program (which causes all memory to be wiped on BREAK) it is possible to make a program secure against copying. However, discs with E attributes work correctly with *BACKUP thus defeating any copy protection ideas. In any case, anyone who can disassemble a machine code program probably also has the wit to get the bytes of the file directly off the disc using a sector editor.

£10 RAMLESS PROGRAMS

Simon Young of Fareham was reading through the yellow pages of June's *BAU* and noticed a slight problem with the *Dropkick* utility written by Jeff Tullin, in that it attempts to preserve all zero page workspace, but nevertheless fails to preserve address &70.

As he has had the same problem with his own programming, he has written with a solution, which shows you how, by careful use of the stack, to avoid corrupting any zero page Ram with your sideways Rom handling software.

This is a major problem for writers of service Roms, and although I have seen the solution used by professional programmers, I have never seen it in any book or article.

Often when writing utilities to operate from sideways Rom (or Ram) it is undesirable to reduce program workspace by claiming pages of memory for use by the Rom. Invariably, however, the Rom will have to use some Ram as workspace.

In such cases programmers usually make use of the section of zero page reserved by Basic for the user (ie &70-&8F).

Although it is unusual for languages and wordprocessors to use this section of memory for anything other than temporary workspace, programmers often make extensive use of zero page. It is vital that the Rom utility restores the values which it overwrites so that it will be compatible with user programs (which may call the SWR utility) and languages alike.

Dropkick highlights the real problem quite nicely. If you examine the program you will note that although an attempt is made to restore the zero page workspace used, &70 remains overwritten with the value of

the accumulator (the service type requested) on entry to the Rom. If a program calling this routine was using &70 things might not work out as intended.

So the real problem is the need to preserve zero page workspace and at the same time both preserve and make use of the vital information stored in the accumulator, X and Y registers on entry to the Rom.

You cannot use the workspace because you need first to preserve it and you cannot preserve the workspace without overwriting the accumulator.

The answer to your problem is to make use of the stack. On the BBC and the Master alike, the stack occupies page one (&100-&1FF).

In fact, it is more true to say that the stack occupies &1FF-&100 as the stack works backwards from &1FF with the low byte of the next available stack address being stored in the stack pointer. Hence when you push a value onto the stack it is stored at &100 plus the value of the stack pointer and the stack pointer is then decremented

And when you pull a value off the stack the stack pointer is first incremented and then the value stored in the address &100 plus the value of the stack pointer is read.

This said, it becomes easy to push values onto the stack and make use of them later by reading them directly rather than pulling them off the stack.

Say you want to preserve all of the user zero page space (&70-&8F) and write the entry values of the A, X and Y registers to &70, &71 and &72 respectively, and write the stack offset (from &100) of the pushed values of the A, X and Y registers to &73, &74 and &75 respectively.

This can be done with:

```
       PHA
       TXA
       PHA
       TYA
       PHA
       TSX
       INX
       LDY #&8F
.store LDA &0000,Y
       PHA
       DEY
       CPY #&6F
       BNE store
       LDY #&02
.write STX &73,Y
       LDA &0100,X
       STA &70,Y
       INX
       DEY
       BPL write
       LDA &70
       LDX &71
       LDY &72
```

The reasons for also making a note of the stack location of the A, X and Y register stores are twofold.

Firstly, this allows you to use &70, &71 and &72 as temporary workspace for these registers as you may at any time read their original values and secondly, it allows you to write specific return values of these registers to their stack locations which would then be read in the return routine:

```
            LDY #&02
.returnreg  LDX &73,Y
            LDA &70,Y
            STA &0100,X
            BPL returnreg
            LDY #&70
.restore    PLA
            STA &0000,Y
            INY
            CPY #&90
            BNE restore
            PLA
            TAY
            PLA
            TAX
            PLA
            RTS
```

The only possible snag which I can see with using this technique is that heavy use is made of the stack.

The reason this might be a problem is that some service paged Roms use &100 upwards to store error messages.

This said, the chances of you overwriting these messages is almost nil.

Since we began with the *Dropkick* utility, this seems like a good place to end.

With the following amendments to the SWR listing 1 of June's *BAU*, the problems that were identified earlier are now overcome:

```
145 astac=&70
440 PHA
530 LDX #8
550 LDA &70,Y
599 TXA:PHA
600 TSX
601 STX astac
602 LDA #14
603 ADC astac
604 STA astac
605 LDX astac
606 LDA &0100,X
607 STA accum
608 PLA:TAX
609 LDA accum
685 LDX astac
686 LDA acccum
687 STA &0100,astac
720 STA &70,X
740 CPX #8
840 PLA
```

£5 PRINTER CLINIC

Mr V Morton from Leatherhead read my printer article in July, and has made some interesting points. Firstly, something I did not know, is that true A4 paper measures 250*2^0.25 millimetres along the long side, which is 297.30, not exactly 297 as is usually quoted. Mr Morton's main point however is that on all A4 continuous stationery that he has seen, there have always been 23 1/3 pin holes precisely. As the pinholes are spaced at half-inch intervals, and printer lines are normally one sixth of an inch apart, this makes the paper extend to exactly 70 lines with no cumulative error on printing. The paper is 11 2/3 inches long which is not exactly A4, as explained in my article.

Upon checking my own stock of A4 continuous paper, I find it is indeed like this, but the original article was also based on comments received from many users over the years about A4 paper in dot matrix printers.

Mr Morton goes on to point out on behalf of his Citizen Swift 24 printer that it can do nine-pin graphics without elongation – all you need to do is to switch to IBM emulation. Although some of the Epson commands no longer work, all the important ones do, including colour changing when using the Swift's optional colour kit. This is, I expect, because the IBM mode is in fact emulating an IBM Proprinter, a nine-pin model, and it will be the 24-pin commands which do not work. This doesn't seem to affect the quality of the LQ print, which is still up to 24-pin standard when in this mode.

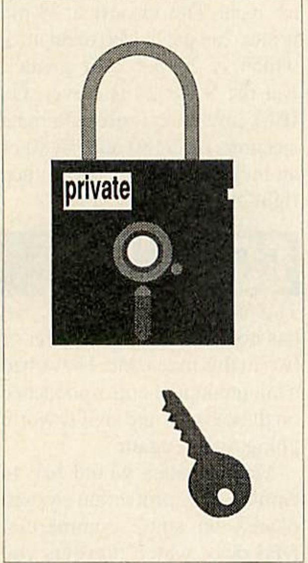
In nine-pin graphics the dots are uniformly spaced at 1/72 of an inch. The closest a 24-pin printer can get is 1/60 of an inch, which is 20 per cent greater. But the Swift 24 is clever. On IBM emulation it uses alternate spacings of 2/180 and 3/180 of an inch, and this works out just right overall.

£5 DFS CATALOGUE PROTECTION

This is a fairly old subject, but has not been aired for a year or two in this magazine. I have had a fair amount of correspondence on the subject, and so it is worth going over it again.

Many readers would like to emulate the protection system placed on some commercial DFS discs which prevents you from looking at the catalogue of the disc, so that the *CAT command doesn't work.

Mark Lomas from Warrington has sent in a pair of programs, one of which protects or



unprotects the catalogue, the other allows you to view the catalogue of a protected disc.

Catalogue protection works by placing a Ascii code 21 in the title string. Ascii 21 is a control code which disables VDU output, and therefore if this code is inserted in the title string, then all VDU output after the title will be inhibited. As the first thing printed when you type *CAT is the title of the disc, then effectively nothing is displayed except those characters in the title which precede the code 21.

Note that this method does not re-enable the VDU after *CAT has finished. It is possible to do this, but fairly difficult as it involves embedding an 'enable VDU' code (Ascii 6) as the last character of the last filename on the disc. However, if you try to catalogue a disc the computer appears to lock up, because nothing you type, including ESCAPE seems to have any effect. You can recover normal output by typing CTRL-F on the keyboard, which is of course equivalent to typing VDU6.

The first of Mark's programs (both of which can be found in the yellow pages) is a Basic program, and should be typed in, saved and then CHAINed. A menu is offered at which you type '1' to protect a disc and '2' to unprotect it.

You are then asked which drive contains the disc you wish to protect. In normal DFS fashion, this can be 0, 1, 2 or 3, as DFS treats each side of a disc as a separate drive.

If you wish to protect a disc which is in the same drive as that from which you loaded the program, be sure to remove the program disc first and insert the correct disc before you select the drive.

The program loads in the first sector of track 0 of the disc, where the catalogue is contained. The first eight characters of the disc title is stored in the first eight bytes of this sector. The rest of the title is stored in the first four bytes of the second sector, but to achieve this effect you only need to look at the first sector.

To protect the disc, the first eight bytes are filled with the Ascii codes for the string 'Secret!' followed by code 21, which is exactly eight bytes. Nothing else in the sector is altered and the whole sector is then written back to disc.

To unprotect the sector, all that is necessary is to remove the code 21. The program removes the message as well by setting all the first eight bytes to zero, effectively removing the first eight bytes of the title.

Note that if the original title prior to protection was longer than eight characters, then only the remaining characters will reappear.

The program uses the usual OSWORD &7F routine to read in the catalogue sector, and the

same call to write the sector back after alteration.

Note that if you have a disc sector editor such as that contained in the Watford DFS, *Disc Doctor* or *Advanced Disc Toolkit*, then you can effect and remove this protection without resort to this program. All these sector editors, if started up without parameters, automatically load in the first sector of the first track, which is the sector you want to alter.

To protect the disc, enter the word you wish to appear before VDU output disappears into the first bytes (starting from byte 0, at the top left of the sector display) and then after the last character of the word enter the value 21.

Most sector editors allow you to enter data in either hex or Ascii format, normally toggled with the TAB key. The text of the title to be displayed should be entered in Ascii mode, and the code 21 in hex mode – 15. To unprotect a protected disc, change all of the first eight bytes in sector to zero (or you could just change the byte containing 21 to a printable character).

To effect the change, just save the altered sector back to disc. Be careful not to change any other bytes in the sector or you may find that the filenames have been changed.

The second program Mark provides is a machine code program which should be typed in from the yellow pages or loaded from the monthly disc, and then run. Running it creates a machine code program called PASSCAT.

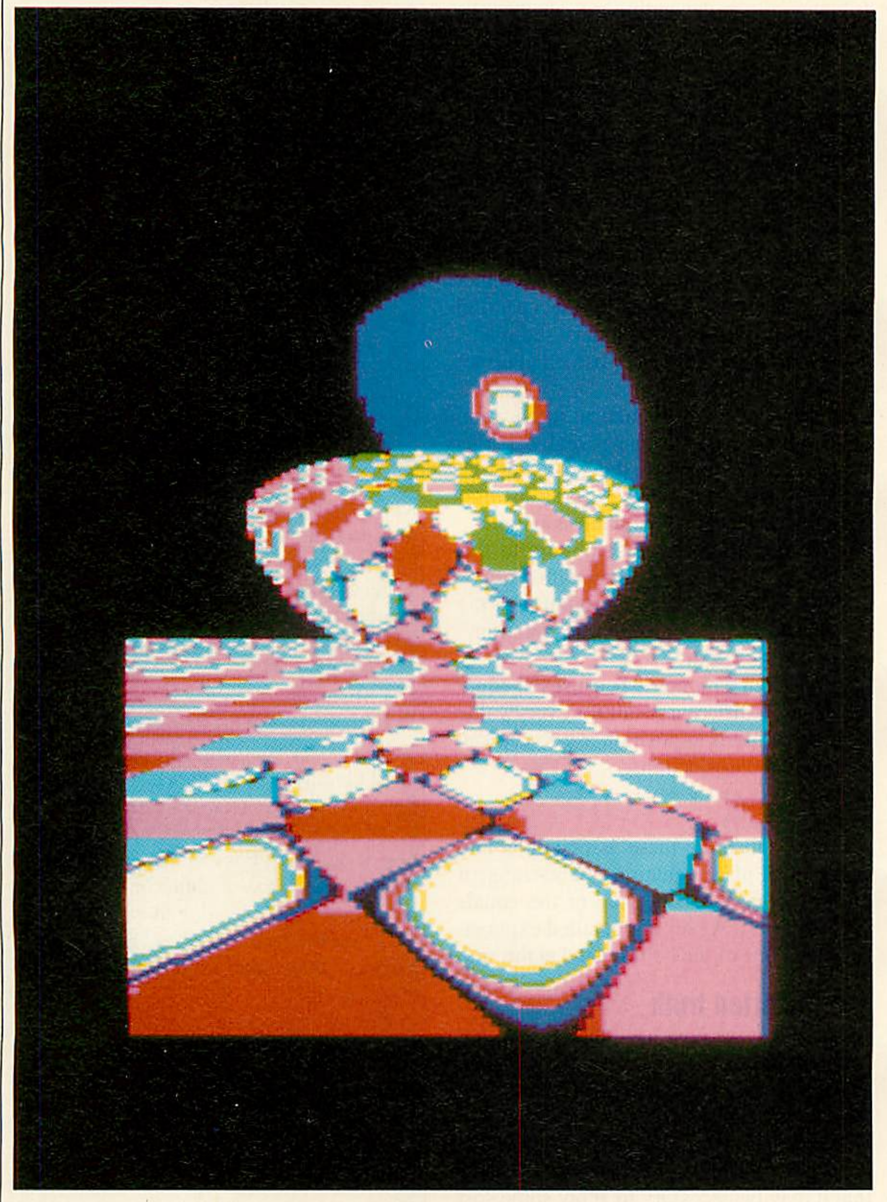
If you run this program, by typing *PASSCAT, it prompts you for the drive number in which the protected disc is contained. If you only have a single drive, you might swap discs at this point. After you have keyed the drive number (there is no need to press RETURN) the relevant drive will be catalogued in the normal way, whether or not it is protected.

This routine will also catalogue discs which have been catalogue protected by other methods, including those which have Ascii 21 in filenames as well as in the disc title.

It works by redirecting screen output (the OSWRCH call) to a routine .print which checks whether the character being sent to the VDU drivers is 21, and if so replaces it with 42, the code for an asterisk. Any 'disable VDU' codes can be identified on screen as asterisks.

The routine then issues the normal CAT command through the OSCLI routine, the command being appended with the drive number you typed at the prompt. Finally the routine 'unhooks' the redirection of OSWRCH and restores the normal vector. The protected catalogue system does deter the casual user from prying into how you have set your disc up. However it is not foolproof – for example the *INFO *.* command will display the names of all the files on a protected disc.

If you have any hints or tips for the eight-bit range of Acorn machines, we would be pleased to hear from you. Submissions may or may not include a program, but should run to between 300 and 1500 words of documentation. Particularly welcome are tips which increase productivity, such as enhancements for popular programs, or explanations of difficult topics, rather than just programming demonstrations. Send your ideas to David Atherton, Eight Bits, BBC Acorn User, *20-26 Brunswick Place, London N1 6DJ.*



Last year's feature on Beeb and Arc ray tracing met with a very enthusiastic response from readers. So by popular demand, **RICHARD BROWNING** delivers a second dose of arcane and learned optical lore

RAYS OF SEEING

Do you remember the ad for Access which had cute little duckies floating around a credit card? (No, I didn't get the connection either). That was 'ray tracing', a way of generating the most realistic images obtainable using a computer graphics system.

It involves tracking rays of light through a predefined scene (see figure 1) in which all the objects – spheres, walls and so on – have their own characteristics, for example a reflective tabletop or a matt squash ball.

Ray tracing can't simulate everything in nature – yet. Limitations exist, not least the speed at which an image is rendered. Real-time ray tracing remains a dream, but with the introduction of ever-faster processors, who knows what might happen?

I wouldn't want to give an average rendering time for the program accompanying this article, but the realistic minimum is about one hour for the Arc and several hours for the Beeb.

Plane speaking

An infinite number of objects can exist in any scene, each having its own physical characteristics and visual parameters. But computers have only finite resources, especially the Beeb. So, for this implementation, I'll introduce only the two most common objects – spheres and planes.

The first thing we must do is decide how to represent a ray in the computer. This ray is the one we trace emanating from the viewer's eye, back through the pixel on the VDU and hence into the scene. We need to know which objects the ray hits and where it intersects those objects.

The ray is traced back from the eye through the pixel. If it were the other way (ray through pixel to eye), an infinite number of different rays could pass through that pixel into the eye.

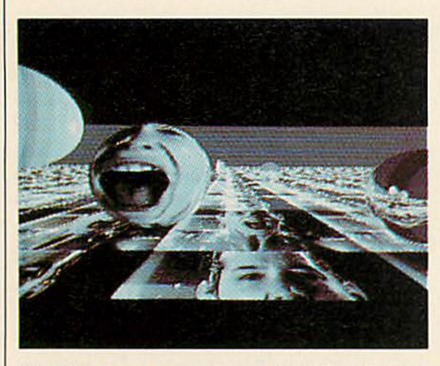
A ray has three components, all defining its direction of movement through 3D space in terms of x, y and z movements (horizontal, vertical and depth). We call the ray a 'vector' and, to find its absolute position in space, its starting point is also required.

The ray, therefore, has both a direction and an origin defined thus:

$$\text{Rorigin} \equiv \text{Ro} \equiv [\ X_o\ Y_o\ Z_o\ ]$$

$$\text{Rdirection} \equiv \text{Rd} \equiv [\ X_d\ Y_d\ Z_d\ ]$$

Most vectors used in ray tracing are 'normalised' which means that the x, y and z



direction components are altered so that the sum of their squares equals 1:

$X_d^2 + Y_d^2 + Z_d^2 = 1$

Arbitrary units

To represent mathematically a line which has been defined by a vector, then the vector's origin (R_o), its direction (R_d) and some factor (we call it t) determining the length of the line or the position of the final point of the line are needed:

$R(t) = R_o + R_d * t$

Variable t can take any value – obviously the greater it is, the longer the line.

At last, we can mathematically define a ray (and line) in 3D space. But there's not much point in having a ray if there's nothing to connect it with.

Somehow, you have to determine if and where a ray strikes an object. This means you need to know how to represent an object mathematically.

Let's deal with spheres first. There are two ways of testing to determine ray-sphere intersections. The first uses algebra and the second geometry. I've chosen the latter as I used algebra in my last ray tracing article, and geometry also happens to be quicker.

Remembering the aim of all intersection methods is to give the value of t so that co-ordinates can be calculated for the intersection point, look at figure 1. Try and identify the ray, the radius of the sphere and look at the brief notes accompanying the diagram.

Don't worry if you don't understand. The theory does work, believe me! (There's a list of reference material at the end). All spheres have a centre and a radius and using these parameters a solution for the sphere can finally be achieved:

$t = t_{ca} +/- SQR(t^2_{hc})$

(plus or minus depending on whether the ray begins inside or outside the sphere).

The advantage of this geometrical solution is that checks can be made during the computation which may cause the routine to report that the ray missed the object.

The next object we have to check for is the plane (figure 2). The only sensible way to work this one out is to use algebra. A plane can be defined as a vector with four components – all those of a ray, but another one which also determines the 'parallel movement' of the line, to make the plane. The components are neatly parcelled up so:

`Plane ≡ [ A B C D ]`

Through dint of mathematical application and copious study, I can reveal that this vector is really the same thing as:

`(Plane ≡) A*x + B*y + C*z + D = 0`

This is, oddly, called the plane equation.

How does one find the solution to this with regard to an intersection with a ray?

Well, remember that any point of a ray can be shown by the parametric equation:

$R(t) = R_o + R_d*t$

This is called parametric because the equation gives a different result for every value of t. If the ray is at position x y z, you can then take the assocations:

$x = x_o + x_d*t,\ y = y_o + y_d*t,$
$z = z_o + z_d*t$

We then substitute these associations into the original plane equation and rearrange it all so we get t on one side of the equals sign, by itself. Again, for detailed explanations, get one of the books listed at the end.

The distorted truth

Assume that we now have the intersection point in 3D space of the ray and the object. What about the object itself? It can be reflective, transparent, dull or whatever.

We'll deal with some of these possibilities later, but for right now just consider that it may be necessary to apply some sort of pattern to the surface of the object. For example, a plane may actually be a painting so we need to map the plane onto a sprite which itself holds the 2D representation of the painting. Or we may wish to render a globe complete with surface map, stored as a sprite.

Alternatively, instead of a sprite a mathematical function can be used which describes the intensity of every point on the map. These processes of mapping a 2D object onto a 3D one (or 2D-2D, 3D-2D) are generically termed texture mapping.

A texture mapping procedure needs several things: the type of 3D object it's mapping onto and any relevant dimensions (such as the vertices of a polygon or the radius of a sphere), the intersection point and also the 2D object it's taking the map from (for example, a sprite or mathematical function).

Mapping a sphere is, conceptually at least, a simple task. We basically want to

BEEB AND ARC DIFFERENCES

Beeb owners will have to save the PROCgetcoeffs from the Arc version as a separate file. As downloading occurs,the scene data will need to be compiled prior to downloading so that it can be saved.

I have defined a mono palette in mode 2 on the Beeb – so turn the colour down.

Beeb owners can't enjoy the sprite mapping facilities of the Arc, so must insert a mathematical function in FNgtext (Arc owners can do this as well if they want).

SETTING THE SCENE

The scene is described as a series of DATA statements after the program, each describing an object. Be warned: complex objects mean long DATA statements. The DATA format for one object is:

```
DATA Obj_type, Pos_Args, Intensity,
Surface,
[Ind_refrac/Vertex_list]
```

Taking each parameter in turn:

- Obj_type is 1 for spheres or 2 for planes.
- Pos_args is actually a series of parameters which define the bounds of the object. For a circle, these are the x, y and z co-ordinates of the centre followed by the radius. For a plane, these are the A, B, C and D arguments (see below).
- Intensity is the initial intensity of the object, which is a value from zero to 15.
- Surface Individual bits can be set within this parameter to give the nature of the surface. For a simple surface, the relevant values are:

  1 Matt
  2 Shiny
  4 Mirrored
  8 Opaque (refract)
  16 Texture-mapped
  32 Quadrilateral-mapped

For a complex surface, these values can be added together to give any combination of qualities. For example, a shiny mirrored surface has a value of 2 + 4 = 6. Note that only planes can be quadrilateral-mapped, and if they are texture-mapped, they must in addition be quad-mapped too.

The last parameter is optional and represents either Ind_refrac, the refractive index, which applies only to spheres, or Vertex_list, a list of vertex co-ordinates on which the plane equation can be based (see Examples).

The A B C D parameters for the plane data arguments are obtained for any given plane as follows:

- List the four vertices for the polygon.
- Call PROCgetcoeffs whose parameters are the four 3D co-ordinates.
- PRINT A,B,C,D.

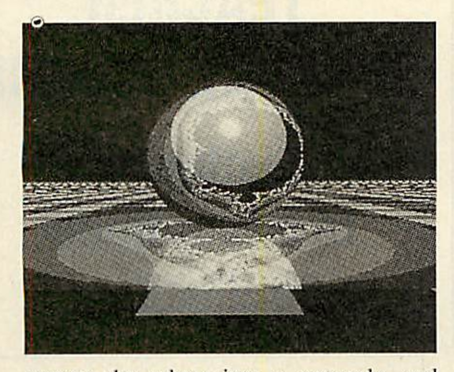
Here's an example:

```
>PROCgetcoeffs(2800,-200,2000,2400,
-200,0,3400,-200,0,3200,-200,2000)
```

You may find that the numbers returned are quite huge. In this case, try and find a common denominator. For example, if A, B, C, and D are 0, 30000, 0 and 90000 respectively, simplify to:

`0 1 0 3 !!!`

If you specify a texture-map for a plane, you must also specify quadrilateral-map (ie 32 + 16 = 48) and supply the four ordinates after the SURFACE parameter in the DATA list. For spheres, the index of refraction must be specified after the SURFACE parameter.



unwrap the sphere into a rectangle, and then to map the intersection point onto this rectangle. The technical term for this process is spherical inverse mapping.

In figure 5, you'll see that we need a vector pointing from the sphere's centre to its north pole, and another vector pointing from the centre to a reference point on the equator. The latitudinal and longitudinal parameters of the intersection point are calculated using these vectors and mapped onto the rectangle to find the resulting point.

To make life simpler, both parameters take values between 0 and 1 along the u (horizontal) and v (vertical) axes of the map rectangle. This means that an Arc screen of 640 X 256 pixels is converted to 1 by 1 unit, which also makes function mapping easier as well (especially where trigonometric functions like sin, cos and tan are used). Plane mapping is rather more involved. Firstly, note that the plane equation given above has no limits, meaning that the plane the equation describes has an infinite extent. For a mapping process, we clearly desire some reference points.

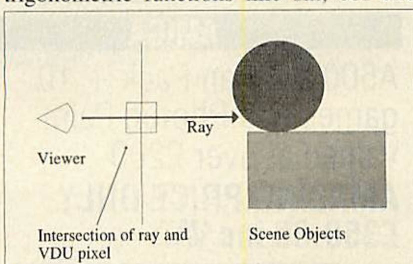


Fig 1. Tracking light rays

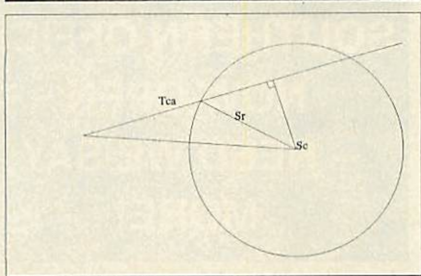


Fig 2. Calculating ray-sphere intersections

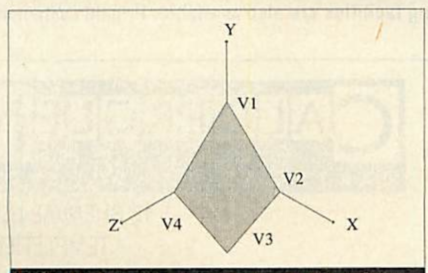


Fig 3. The vector components of a plane

For mapping onto a rectangle, it seems sensible to use four points (or vertices) on the plane which describes a polygon, within which you can apply texture mapping (we can also use the polygon to limit a plane anyway, whether or not we wish to apply texture mapping).

The technical name for all this is 'convex quadrilateral inverse mapping' If you look at figure 6 you'll see a diagram of a distorted quadrilateral. Given an intersection point R_i, we need to map this point onto the sprite or function unit rectangle (by unit, I mean with extent of 0..1 by 0..1 as for the sphere rectangle map).

As the book says, the method for polygon mapping involves deriving a function which describes the polygon's perpendicular plane axes from the co-ordinate system origin (meaning [0 0 0]).

This supplies us with an equation which is plane-dependent. This in turn is used to map Ri onto (u,v). The method can be speeded in certain areas, for example checking to see if the axes are parallel or if any of the square roots would give imaginary results (No, the computer doesn't dream! An imaginary number is the square root of a negative number. The theory behind imaginary numbers is used in the generation of fractals and the Mandelbrot and Julia sets).

On reflection

Now you know how to represent a ray and how to calculate if it intersects with an object, and also if that object has any form of map associated with it.

But the object could be reflective. And the components of reflection could be specular, diffuse or ambient. A light shining on an apple gives highlights. This is specular reflection. The dull glow from a squash ball is diffuse reflection. But don't forget, though, 'proper' reflective surfaces, like mirrors. Ambient reflection is not really reflection, it's just the normal (unaffected) intensity of the environment.

Specular reflection is one of the hardest components to model in ray tracing, so I'll stick to what is called 'perfect specular reflection'. This component is the part of the incident ray from the light source which is reflected from the outer surface of the object, in a direction whose value is entirely dependent on the angle of the incoming light ray. This also means that, if white light is shone onto a blue shiny object, the highlights are white and not blue.

So, specular reflectance is directional, dependent on the value of the incident light – light reflects only if the angles of incidence and reflection are equal (see figure 3).

EXAMPLES

(Note that instead of ORing SURFACE types, you can add them to get the final type)

Infinite mirrored plane at y=200:

```
DATA 2,0,1,0,-200,0,4
```

Shiny sphere at (300,400,200), radius 200:

```
DATA 1,300,400,200,200,3,2
```

Shiny sphere at (300,400,200), radius 200 and also texture-mapped:

```
DATA 1,300,400,200,200,3,18 (2 + 16 = 18)
```

Opaque sphere at 0,0,0, radius 90 and refractive index 1.33:

```
DATA 1,0,0,0,90,0,8,1.33 (RI
specified after SURFACE parameter)
```

For a more complex example try this texture-mapped plane with mirrored surface and vertices as given in the example above:

```
DATA 2 (plane)
DATA 0,1,0,200 (A, B, C and D)
DATA 0 (Intensity added to texture map)
DATA 52 (mirrored = 4 texture-map = 16
```

(You also need quad-map = 32 which gives 52 when added together)

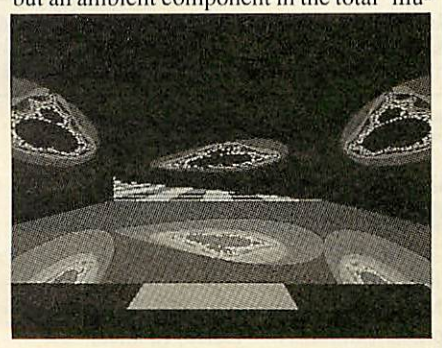
```
DATA 2800,-200,2000,2400,-200,0,3400,
-200,0,3200,-200,2000 (the 4 vertices)
```

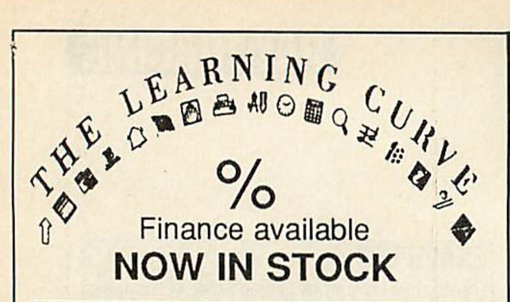
Note that there's a coefficient associated with the specular reflection calculation (ks). This determines the 'spread' of the highlight – such a small parameter can have dramatic results on an image.

Diffuse reflection, on the other hand, is not reflection in a determined direction; instead it is light which is scattered equally in all directions so that the surface appears to have the same brightness when viewed from all angles. This is unlike specular reflection, which seems to follow you if you change your viewing angle (see figure 4).

A very important mathematical function in ray tracing is the dot product, used in almost every rendering methodology. This function, whose parameters are two vectors, returns the angle between those vectors. The function is used directly in the computation of diffuse reflection, whose value is multiplied by some illumination constant to provide the final intensity value of the point.

Ambient light is simply a constant illumination on all objects, regardless of their orientation. Images rendered using just ambient light are boring and unrealistic, but an ambient component in the total 'illu-





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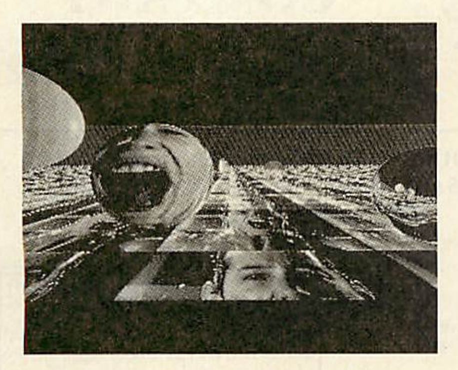


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mination equation' is almost always required. It forces objects to be visible.

The same method for calculating the reflection vectors in specular reflection is used for bouncing rays off reflective surfaces like mirrors. The derivation is quite involved, but relies on the fact that the angle of reflection from a surface is the same as the angle of incidence (figure 5).

Next on the list is refraction. An example of refraction is a stick in water which seems to bend at the point of contact.

The angle at which the image, or ray, is bent is entirely dependent upon the 'refractive indices' of the two adjacent media. The refractive index of air, for example, is pretty close to 1 and, for water, it is about 1.33 (both figures are ratios with respect to a vacuum). Normally, the index of one medium is divided by the index of the other, giving a fixed relationship. This value determines the angle at which the ray bends by a rule known as Snell's Law.

The refracted ray can be derived either by an algebraic approach or by the geometric route. I've chosen algebra.

The final formula for the refracted ray and a diagram are given in figure 4.

Basic geometry

A surface can be defined which is quite capable of both refraction and reflection, like water. When this happens, the ray splits into two: one following the refracted path and the other following the reflected path. Either of these rays may then continue this process, continually dividing if necessary, until a termination condition is reached, such as the ray leaving the scene.

Picture this as the first ray (the one leaving the eye of the viewer) as the root of a tree, which when confronted by both refraction and reflection causes the tree to branch. Each branch then follows the fate of both rays. Further branching may occur.

Such a structure obviously indicates the need for a recursive algorithm. Briefly, a recursive program is a program which can call itself. So that the recursion may be stopped at any level, it is necessary to have a terminating condition (ray leaving scene).

The program given in the yellow pages (page 84) is a fairly complex renderer, capable of displaying any number (memory limited) of planes and spheres. The objects can be texture-mapped (and in the case of planes, polygon-mapped), have surface characteristics of diffuse and specular reflection, refraction, and mirroring. Real (not integer) variables are used, so a wide space is available for the placement of objects.

The ground, an infinite plane placed at y = -500, is the infamous tartan.

There are several constraints: only one light source has been defined, refraction is restrained to spheres only and spheres with refraction characteristics mustn't intersect with any other object (lack of memory), even though if such an intersection does occur the program won't crash, only produce odd results; the position of the viewer is defined in the variables px, py and pz (in the Arc version) and it's only possible to look in the z direction.

The 'focal length' of the 'camera' is defined by the distance of the viewer from the screen plane, defined by the variable Screen_z. The larger this is, the greater the zoom.

The specular reflection coefficient is global to all objects, although the refractive indices are local to the spheres.

You can get a lot of fun from ray tracing. The screenshots give an idea of what can be achieved – the possibilities are endless.

References

Fundamentals of Interactive Computer Graphics, J.D.Foley,A.Van Dam, Addison Wesley, ISBN 0-201-14468-9, pp664. Takes the reader from the very basic input stuff through to bezier curves and more.

An Introduction to Ray-Tracing, edited by Andrew S Glassner, Academic Press, ISBN 0-12-286160-4, pp327. The best book for those who know computer graphics and wish to branch into ray tracing.

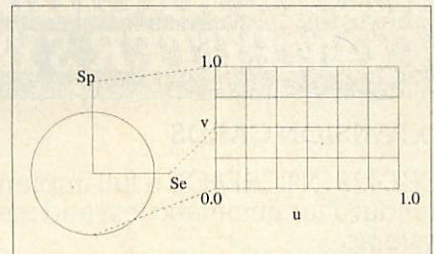


Fig 4. Spherical inverse mapping

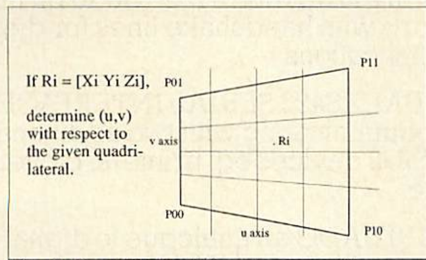


Fig 5. Quadrilateral inverse mapping

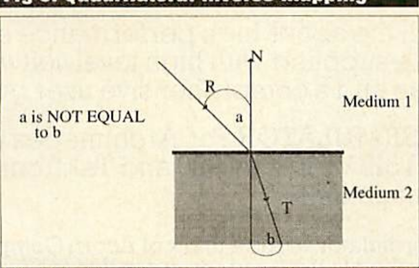


Fig 6. Refraction at a media boundary

Procedural Elements for Computer Graphics, David F Rogers, McGraw-Hill International Editions, ISBN 0-07-Y66503-6, pp433. Excellent tome, recently out as a second revised edition.

Fundamentals of Three-Dimensional Computer Graphics, Alan Watt, Addison-Wesley, ISBN 0-201-15442-0, pp430. A how-to, rather than a why-to, book.

PROCEDURES AND FUNCTIONS

FNfloor	Returns an intensity, dependent on where the ray lands.
FNtrace	The main routine. Checks for ray intersections, calculates intenstities and if necessary recurses for new ray branches.
FNhit_sphere	Called by FNsphere, this returns TRUE or FALSE depending on whether the ray intersected the sphere.
FNsphere	Obtains parameters to define sphere, calls intersection routine and if necessary sets variables defining the hit location.
FNplane	As FNsphere, but for planes
FNhit_plane	ditto
PROCgetcoeffs	Translates scene data
FNdiff	Returns the intensity of a point subject to diffuse radiation.
FNspec	Returns the intensity of a point subject to specular radiation.
FNmirror	Calculates reflection vector of incident ray and calls FNtrace.
FNopaque	Ditto, but for refraction vector.
FNtmap	Calls a mapping routine, depending if the object is a sphere or plane.
FNsmap	The sphere mapping routine. Returns intensity.
FNpmap	Polygon mapping routine.
PROCxprod	Another function vital to ray tracing, the cross product.
FNdot	As discussed above.
PROCrefl	Calculates reflection vectors.
PROCnormalise	Normalises vectors.
FNgtext	The routine which gets the intensity from the rectangle texture map.
PROCsetpalette	Sets the palette for a grey scale.

STRETCHING A POINT

Some very powerful graphics routines are hidden inside the Arc. **CHRIS RUSEMAN** explains how to tame the Draw module and harness it to your advantage

Quite recently I was fiddling around with *!Draw* trying to draw some simple 3D scenes. All I wanted was a couple of perspective cubes with pictures drawn with *!Draw* on their sides. Unfortunately, despite all the various functions provided by *!Draw*, there is no general 'distort' option – for example, given a rectangle, this would provide the ability to stretch its corners individually into an arbitrary quadrilateral. So, armed with nothing more than some very early Acorn documentation on Draw files and the Draw module (an integral part of Risc OS), I set about writing a utility, *!Stretch*, to do exactly this.

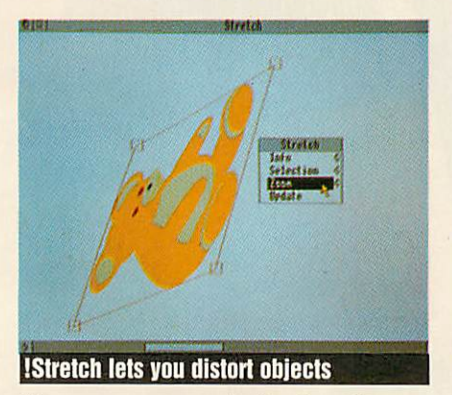
Doing a stretch

!Stretch is a standard Risc OS application. Once installed on the icon bar (by double clicking the *!Stretch* icon), Draw files can be dragged onto it either from the filer or directly from *!Draw*. Click on the *!Stretch* icon and a blank Stretch window will appear on the screen. Any files dragged or 'saved' onto this window from *!Draw* will appear at the pointer position.

Up to eight objects may be present in the *!Stretch* window at a time, although only the currently selected one may be moved, stretched, saved or deleted. To select an object simply click on it with the Select button. The bounding box will then appear in red.

To move an object simply click on one of the corners of its bounding box with the Adjust button and, holding this button down, move the object to the desired place. To stretch one corner, click on it with Select and move it in the same way.

A menu is provided and this can be pulled up with the Menu button. If you have selected an object, the Selection sub-menu will be available. Click on Delete to remove that object or go to the Save option if required. You can save the object as a Draw file or, more conveniently, drag the save icon onto *!Draw* itself.



!Stretch lets you distort objects

The Zoom option allows you to change the scale of the *!Stretch* window. Any scale from 1:8 up to 8:1 is allowed. Either click on the arrow buttons or enter the scaling factors directly at the caret.

The last option on the menu is Update. Clicking on this will switch the 'continuous update' facility on or off. If it's on then when dragging or stretching an object it will be redrawn whenever possible. If it's off, just the bounding box of the objects will be shown.

The listings

You'll find two listings on the yellow pages. Listing 1 is the main program and should be saved as !RunImage in a new directory called !Stretch. Listing 2 when run will create the other files required – !Boot, !Run, !Sprites and !Templates. Checksums are included to avoid typing errors (and of course, the programs are on the monthly disc too).

Much of !RunImage is concerned with the Desktop – the 'clever' stretching procedures are at the end of the listing. The application requires the ColourTrans module (which you'll find on your application discs somewhere) in order to work. Make sure this is loaded, or is somewhere where it can be found (this means in practice saved as !System.Modules.Colours).

Any text or sprites in the file cannot be distorted and are therefore not displayed in the *!Stretch* window. When reloaded into *!Draw* these will appear in their original positions.

The Draw module

Draw files and the Draw module are complicated beasts and an article could be written just on the format and use of them alone. I'll just concentrate on the relevant parts of the module that I've used for the *!Stretch* program.

!Draw files contain an object by object description of a graphical image. Such images are made up of 'objects': paths (lines and curves), bit-mapped images (sprites) and text (both strings and blocks). As mentioned above, we are only interested in the paths, as sprites and text cannot easily be distorted (without dramatically increasing the program size). In addition any number of these objects can be collected together in a 'group'. It is also quite possible for groups to be nested. The structure of *!Draw* is therefore inherently recursive.

The Draw module (built into the Risc OS Rom) is in fact much more versatile than *!Draw* lets on.

It can deal with all sorts of lines and curves and provides many 'hidden' graphical functions apart from the obvious 'please-draw-this-funny-shape' request with which we're all familiar.

However, it does not deal with text and sprites, which therefore need to be handed to the OS and the Font Manager. (This is another reason *!Stretch*

doesn't stretch text and sprites!).

Buried within *!Stretch* is a procedure called PROCdraw. Its first parameter is the address of a block of memory containing a Draw file.

The procedure works its way through the file, isolating the paths and calling the Draw module to plot them on the screen.

This is one of the recursive pieces of code – PROCobject calls PROCgroup (to deal with grouped objects) which in turn calls PROCobject. Don't worry too much about this – just take it from me that it works!

The really important procedure is PROCpath which forms the interface with the Draw module. It converts and expands the data stored within the Draw file into a form digestible by the Draw module.

Unfortunately this is not quite as straightforward as it might have been, hence the various bit shifts.

Luckily, though, the actual path data can be passed directly to the Draw module: this is the sequence of 'move', 'draw', and 'curve' instructions that form the outline of the object.

Two calls to the Draw module are made: one for the actual outline and one for the interior of the object.

The appropriate calls are used depending on the values of the outline and fill colours read from the file. If either outline or interior have 'no colour' then nothing happens, otherwise the ColourTrans module is used to set the closest GCOL available and then either Draw_Stroke or Draw_Fill is called to plot the shape.

Bounding boxes

There is a secondary section of code that also deals with the Draw module. This is the 'bounding box' calculator. Every type of object within a Draw file (except a couple of peculiar ones) has an associated bounding box. This is the area of space that the object can affect when it is drawn. Nothing outside this box will change if the object is drawn. The bounding box of a grouped object will totally cover all the bounding boxes of the enclosed objects. Here comes some more recursion!

The procedure PROCbounds takes the address and size of a Draw file as parameters. As with PROCdraw, it works its way through the file, but instead of drawing paths, it calculates their bounding boxes. Fortunately, one of the 'hidden' calls to the Draw module, Draw_ProcessPath, does most of the dirty work for us. Given a path, in much the same way as Draw_Fill or Draw_Stroke, it returns the bounding box.

My procedure PROCcalcboundbox uses this call to recalculate the bounding boxes of the stretched paths. It also returns the co-ordinates back to its calling routine to allow the bounding boxes of grouped objects to be set up correctly. Finally, the bounding box of the whole file is set (at the end of PROCbounds)

Further maths

The second part of the program, and definitely the shortest, deals with applying the distort transformation. Figure 1 shows the sort of thing we want to achieve. The rectangle ABCD represents the bounding box of an object with point X being an arbitrary point within this box. We want to know the co-ordinates of the point X′ after the rectangle ABCD has been distorted into quadrilateral A′B′C′D′.

As with all maths, breaking the problem down into stages and applying some simple principles makes this relatively easy!

The point X, (x,y) can be represented in terms of vectors as: $\overline{OX}$ and likewise X′, (x′,y′) by $\overline{OX'}$.

The transformation therefore involves transforming $\overline{OX}$ into $\overline{OX'}$. Well, I seem to remember from A-level maths that vectors can be split into their components like this: $\overline{OX} = \overline{OA} + \overline{AP} + \overline{PX}$ as shown in the first part of figure 2. The second part illustrates the same process with the desired transformed image.

We only need to transform each of these three vectors in turn and recombine the result. Problem solved! The details are:

Let α be the proportion of the distance along AB that P lies, and ß be the proportion of the distance along AD that Q lies. In other words:

$$\alpha = (x - A_x) / (Bx - A_x)$$
$$ß = (y - A_y) / (By - A_y)$$

OX′ can thus be found in terms of A,B,C & D as follows:

$$\overline{OX'} = \overline{OA'} + \overline{A'P'} + \overline{P'X'}$$
$$= \overline{OA'} + \alpha(\overline{OB'} - \overline{OA'}) + ß(\overline{OR'} - \overline{OP'})$$
$$= \overline{OA'} + \alpha(\overline{OB'} - \overline{OA'})$$
$$+ ß(\overline{OD'} + \overline{D'R'} - (\overline{OA'} + \alpha\overline{A'B'}))$$
$$= \overline{OA'} + \alpha(\overline{OB'} - \overline{OA'})$$
$$+ ß(\overline{OD'} + \alpha(\overline{OC'} - \overline{OD'}) - (\overline{OA'} + \alpha(\overline{OB'} - \overline{OA'}))$$
$$= \overline{OA'} + \alpha(\overline{OB'} - \overline{OA'})$$
$$+ ß(\overline{OD'} - \overline{OA'} + \alpha(\overline{OC'} - \overline{OD'} - \overline{OB'} - \overline{OA'}))$$

A simple example program called Distort (listing 3) has been provided to show this equation in action without all the complication of Draw file interpretation. A simple shape is shown whose corners may be stretched with the Select button.

This vector equation appears twice in the program, once for the X co-ordinates and once for the Ys. Both of these are in PROCadjust which is called from the procedure PROCdistort. This takes two parameters which are both addresses of Draw files.

These two files should start the same (apart from previous distortions). The first is to read co-ordinates from, the second for storing the new distorted image.

When a file is drawn with PROCdraw, a list of addresses of paths is built up starting at the address points. PROCdistort goes to each path in turn, finding the co-ordinates within that path (for the moves, draws and curves) and uses PROCadjust to transform them.

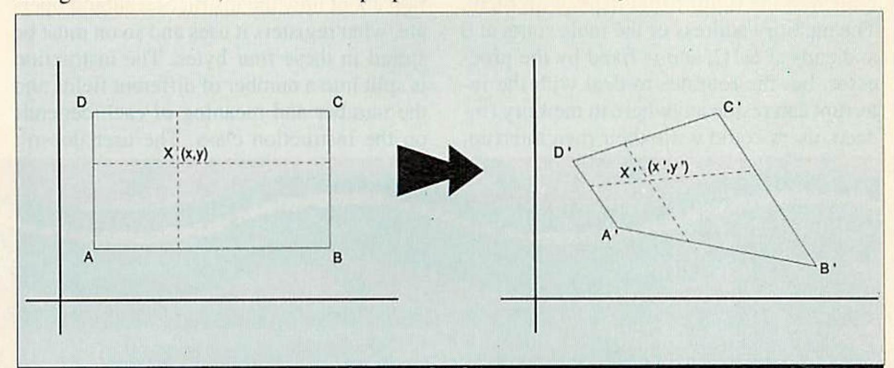


Fig 1. Illustrating the transformation required

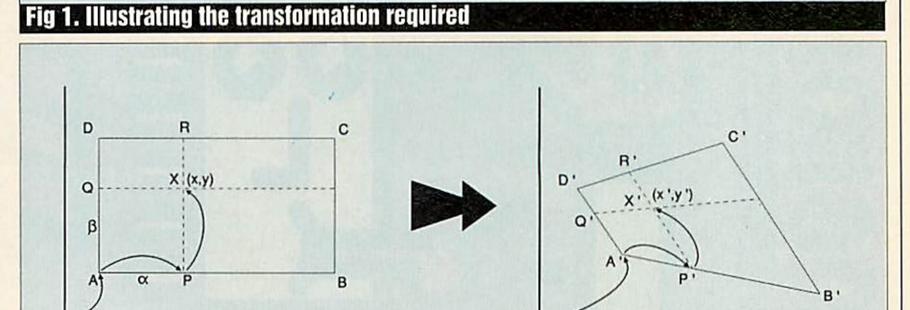


Fig 2. Splitting the transformation into vectors

MAY I INTERRUPT?

JASON O'BROIN continues his series on programming the Arm 2 Risc chip with a look at how to use its software interrupt instructions

Last month I talked in general about the Arm chip. Now I want to look at the instruction set in detail. The first class of instruction only has one member, the SWI (SoftWare Interrupt) instruction. All operating system routines are implemented through this mechanism.

Software Interrupts

An interrupt is an intervention in the computer's normal flow of control, triggered by an outside event. Such a trigger can be provided by the hardware, in which case it is normally outside the user's control. Alternatively it can be produced by software.

An SWI call is a software interrupt. There are a number of interrupts that can occur other than SWI – for example, the RESET signal, which is a hardware interrupt. The operating system has a table of instructions to execute if a particular interrupt occurs.

Normally these instructions will be a branch to the routine that deals with them. The memory address of the table starts at 0 and ends at &1C, and is fixed by the processor, but the routines to deal with the interrupt can reside anywhere in memory (indeed, users could write their own interrupt handlers if they really wanted to).

An SWI call causes an interrupt to occur. The processor SWItches into supervisor mode. Supervisor mode allows read/write access to all of the computer's memory. User mode (the standard mode) doesn't allow this, and some areas of the memory are partitioned off to prevent rogue programs writing to certain sections of memory.

Once in supervisor mode, the program counter is stored. It then branches to memory location 8 (the SWI entry in the interrupt table) to deal with the interrupt. This location contains a branch instruction which sends the processor off to the actual SWI handling routine.

The question now is: how does the SWI handler know what routine the program wanted to call? To answer this, I need to explain how Arm instructions are coded.

Instruction coding

All machine code instructions on the Arm occupy a four byte word. All the information about how the instruction should operate, what registers it uses and so on must be stored in these four bytes. The instruction is split into a number of different fields and the number and meaning of each depends on the instruction class. The user doesn't normally need to worry about this (that is what an assembler is for after all!), but it is instructive to know something about it.

In the case of the SWI call, the top four bits are a code that says which conditions have to be met before the instruction is executed (this is common to all instructions). See figure 1 for details of the different conditions. The next four bits hold a code (1111) saying that this instruction is a SWI. The remaining 24 bits are ignored by the Arm, but are used to specify what operating system routine is being called.

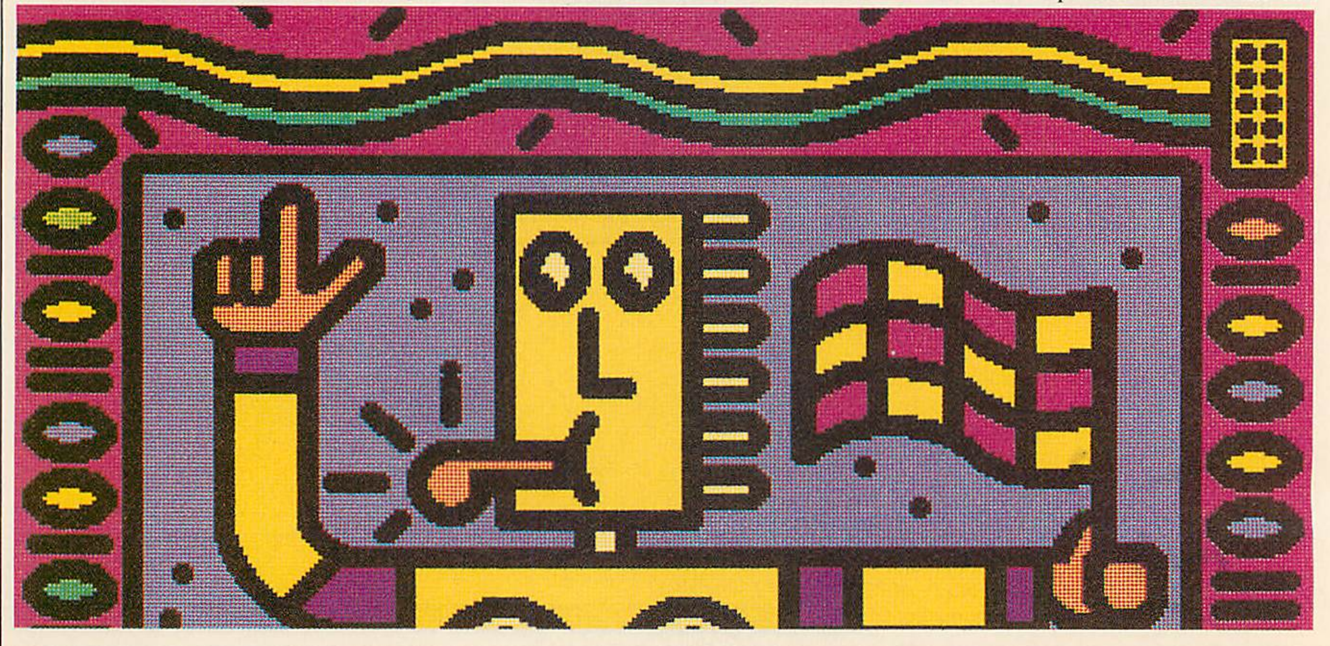
As a result, there are 2^{24} different codes which can be used to specify what routine is required.

SWI decoding

The SWI number is divided up into a number of different parts (see figure 2). SWI numbers are grouped together in blocks of 64 consecutive numbers.

These are called chunks, and each chunk has an identification number (there are 1024 of these), which are generally attributed to different parts of Risc OS. For example, the Wimp Manager has SWI numbers &400C0-&400FF. (The bits that count indicate that this is the third chunk).

The other important feature of the SWI



EXECUTION CONDITIONS

EQ (EQual)	If Z is set
NE (Not Equal)	If Z is clear
CS (Carry Set)	If C is set
CC (Carry Clear)	If C is clear
MI (MInus)	If N is set
PL (PLus)	If N is clear
VS (oVerflow Set)	If V is set
VC (oVerflow Clear)	If V is clear
HI (HIgher)	If C is set and Z is clear
LS (Lower or Same)	If C is clear and Z is set
GE (Greater or Equal)	If N is clear and V is clear or if N and V are set
LT (Less Than)	If N is set and V is clear or if N clear and V set
GT (Greater Than)	As for GE but Z must be clear
LE (Less than or Equal)	As for LT but Z must be set
AL (ALways)	Always, regardless of state of flags
NV (NeVer)	Never, regardless of state of flags

FLAGS

Z : Zero flag	Set when two compared values are equal or if destination result is zero
N : Negative flag	N reflects the state of bit 31 of a result
C : Carry flag	Set if a result is larger than the availiable bits or during shift operations
V : Overflow flag	Set if there is no carry set or if there is no carry from bit 30 to 31 but there is a carry set

Fig 1. Flag conditions used by SWI instructions

numbers is the 'X' bit which is set by prefixing the SWI name with an X. This indicates that if an error occurs, the routine should return to the calling code with the overflow flag (V) set so that the calling code can deal with it itself. So, an SWI call would change from

```
SWI "OS_WriteC" to SWI"XOS_WriteC"
```

More details of the SWI number format can be found in figure 3.

All SWI numbers have an associated name, which can be found in the module that the SWI comes from. The Basic Assembler automatically converts SWI names into their corresponding number, so the use of SWI names instead of numbers is recommended as it helps to improve clarity. The operating system routines "OS_SWINumberFromString" and "OS_SWINumberToString" convert between number and name and vice versa.

Using SWIs

Information for a particular SWI is passed using registers. The numbers that are used depends on the routine, but they start from r0 upwards. Knowing that only r0-r3 (say) are going to be used in the various SWIs you are using means you can leave these registers free, and keep important information in the other registers. All SWIs will preserve the contents of any registers they are not using to pass information back in.

The range of SWI calls available is wide. For example, converting a number into a string and printing it can be performed using only two SWI calls. If r0 contains the number to be printed, r1 a pointer to a resultant string, and r2 the size of the buffer, the following code will print the number:

```
SWI  "OS_ConvertCardinal4"SWI
"OS_Write0"
```

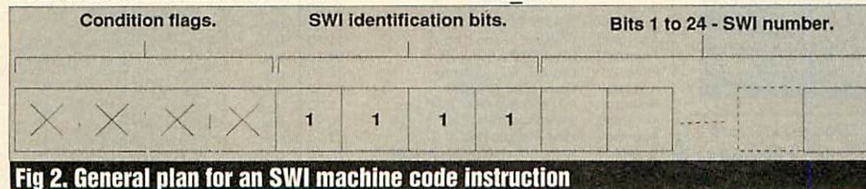


Fig 2. General plan for an SWI machine code instruction

The OS_ConvertCardinal4 returns the address of the string to print in r0 which is the same register that OS_Write0 requires the address to be in.

Changing the OS_ConvertCardinal4 to OS_SWINumberToString, and adding a MOV R0,R1 between the two instructions in the above example would print out the name of a particular SWI number.

Listing 1 gives a better demonstration of this by listing out all SWI numbers and their corresponding names. Don't worry if you don't understand how the whole program works. The comments should give you some idea of what is going on and the rest will become clear after I have covered other instructions in future articles.

Bits and pieces

As listing 1 shows, data can be stored within the machine code program using the directives EQUS, EQUB and so on (see figure 3 for full details). These work by instructing the assembler to store the data at that point in memory. The number of bytes taken depends on the directive.

This can present a problem, though. Due to the way the Arm works, all instructions must be word-aligned, meaning that because Arm instructions are four bytes long, the instructions must be consecutively arranged, and hence have to be at an address divisible by four.

The reason for this is because the program counter assumes that the bottom two bits of an address are 00 (and, by implication, that all the instruction addresses are multiples of four), and so uses these two bits in the program counter for another purpose.

Should you find that by entering data the next address isn't word aligned, the directive ALIGN will instruct the assembler to use the next word-aligned memory location to continue assembling from.

The SWI instruction is an extremely powerful way of interacting with the operating system. The time overhead in finding which SWI should be executed is generally not high enough to cause too many problems.

Next month I will look at data processing operations as these comprise the bulk of instructions the Arm recognises.

SWI number format

bits 20 - 23	Operating system identification Risc Os = 1000 Risc iX = 0000
bits 18 - 19	Determines which part of the system implements the SWI 00 = Operating system 01 = Operating system extension modules 10 = Third party resident applications 11 = User applications
bit 17	The 'X' bit. Determines action on errors
bits 6 - 16	SWI chunk identification number
bits 0 - 5	Identifies induvidual SWI's in a chunk

Fig 3. Details of the SWI number format



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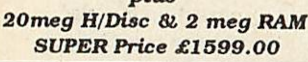


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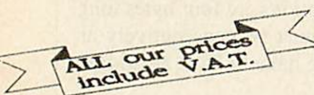


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Misc.	Dotprint + Tecnomatic ROM	13.80
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Misc.	Pro Punter (BM) Discs	34.50
Misc.	Punctuate! (B) Disc	9.20
Misc.	Spanish level A (BM) Disc	11.50
Misc.	Spanish level B (BM) Disc	11.50
Misc.	Spy (B) ROM	13.80
Misc.	Star Stick (B) ROM	11.50
Misc.	Student database (B) Discs	29.95
Misc.	TV Director (B) Disc	19.95
Misc.	Utilities Package (B) tape	4.60
Misc.	Vector 1 Tape to Disc	6.90
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Misc.	Visifax-Viewdata (B) ROM	23.00
Misc.	Vu-Calc (Psion) (B) Tape	9.20
Misc.	VU-File (B) Tape	11.50
Misc.	ZOOM Mach. Code Monitor (B)	11.50
P M S	Multifont fonts (BM) Disc	6.90
P M S	Multifont NTQ (BMC) ROMS	23.00
Pace	Commstar (BM) ROM	17.25
Pace	Micronet Terminal (B) ROM	9.20
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PRES	Adv'd Disc Toolkit (BM) Rom	23.00
PRES	Adv'd ROM Manager (BM) ROM	9.20
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Watford	Office Master (B) Disc	6.90
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Acornsoft	Hits Vol 1 (BM) Disc	6.90
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Audiogc	Graham Gooch TC (BM) Disc	4.60
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(B) BBC B (M) Master 128 (C) Compact (A) Archimedes

TESTS OF CHARACTER

The uses of image analysis range from checking tomato ketchup bottle labels to clearing cheques. **DAVID KNELL** explains how it can make things easier

Last month I explained how to analyse images consisting of blobs and extract information from them using relatively simple techniques. This month I can reveal problems with that type of analysis and as well as other problems, such as character recognition and position checking. Aliasing causes problems when trying to analyse objects which are only a few pixels in area.

The two-by-two pixel object in figure 1 obviously has an area of four, no matter what the threshold, if it lies exactly on four pixels of our image.

When displaced by half a pixel, as shown, then its apparent area may be anywhere between one and nine pixels.

The pixels which are partially occupied by the object will have a grey level somewhere between the background and object levels, and hence are susceptible to small changes in threshold.

Recognise this from somewhere? It's exactly the same process as anti-aliasing, as discussed in the first article in this series.

Anti-aliasing uses the range of grey levels available to allow the edges of objects in an image to be displayed to a resolution greater than one pixel. This procedure can be reversed. You can take an anti-aliased image and locate the edges of objects in it to an accuracy closer than one pixel. This process is called interpolation.

Interpolation allows us to guess how the grey level of an image varies between the centres of pixels. It's quite a simple process – figure 2 gives the general idea in one dimension. Given a set of values at locations 0, 1, 2 and 3 along the line, simply draw straight lines between pairs of points to determine the grey levels in between them. This is called first-order (or linear) interpolation, as since a first-order equation (meaning a straight line) is used to perform the interpolation.

It is possible to use higher-order equations, but the gain in precision falls off as the computation required increases. Third-order interpolation (using cubic equations, where a curve is fitted through four points) is all that is needed.

The first program this month, *Interpol* shows this procedure in action. It randomly positions a two-by-two square on a pixel grid and calculates its area using straight thresholding and linear interpolation.

The yellow dots drawn on the red object show where the interpolation routine thinks it is – it manages a pretty fair guess. For the threshold used (40), the simple thresholder gives areas between three and six pixels – the interpolating one is rarely outside the range 3.7 to 4.3.

Optical character recognition

Optical character recognition (OCR) is another aspect of image analysis. Here, instead of asking for a simple description of an object in an image, a program has to decide which character the object corresponds to. This is usually done by matching

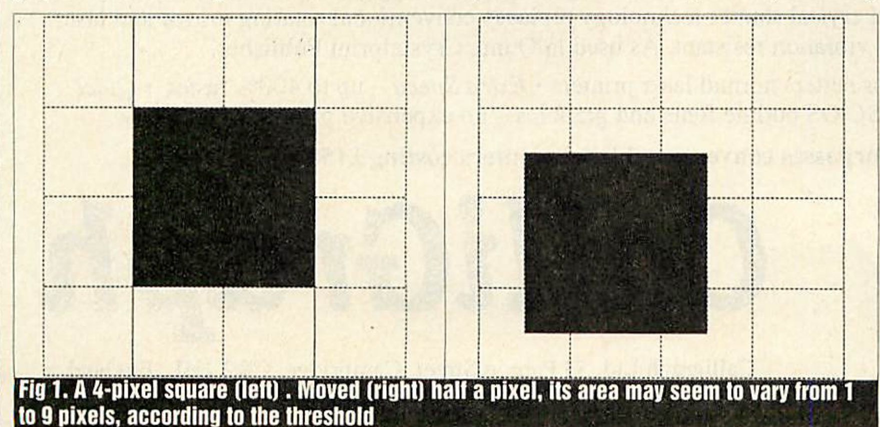
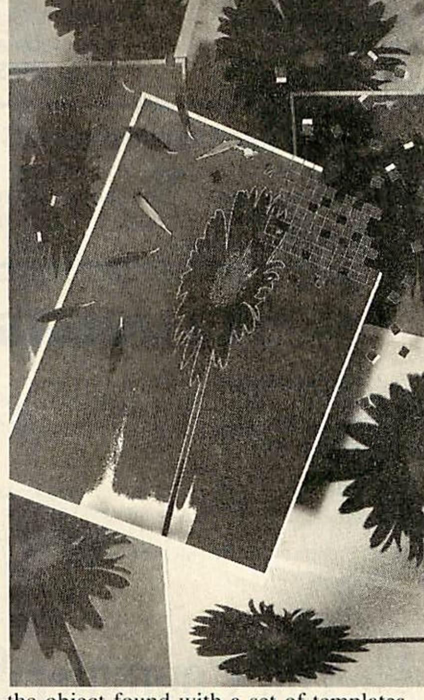


Fig 1. A 4-pixel square (left) . Moved (right) half a pixel, its area may seem to vary from 1 to 9 pixels, according to the threshold



the object found with a set of templates – each of which is one of the letters of the alphabet – and choosing the template which differs least from our object.

So, how are templates matched with objects in an image? The simplest method is to overlay the object with each template in turn and count the number of pixels which differ between the two. This gives us an error value, and choosing the template with the lowest error value should provide us with the best match.

A better method is to add in the distance (or even its square) from the pixel which differs in the template to the nearest one of the same colour in the object. By doing this, errors due to noise around the edges of objects are not taken much notice of, and large deviations are magnified. This sort of pixel-by-pixel comparison is, of course, somewhat limited. It can only cope with those fonts it recognises, and then often only in certain sizes. It is possible to just use one set of templates for a font, but they then need to be scaled to fit the size of character which is being recognised. Another way of recognising characters, which overcomes these problems but has a number of its own, is by looking at the character and counting features.

These include loops, ends and junctions and different characters have different combinations of these. Unfortunately this cannot separate out all the different characters: d and b both have one loop and one end. Hence more (and more complex) processing is needed to relate these features to each other to allow recognition of all characters – the result is slower (and probably less reliable) recognition than a simple OCR

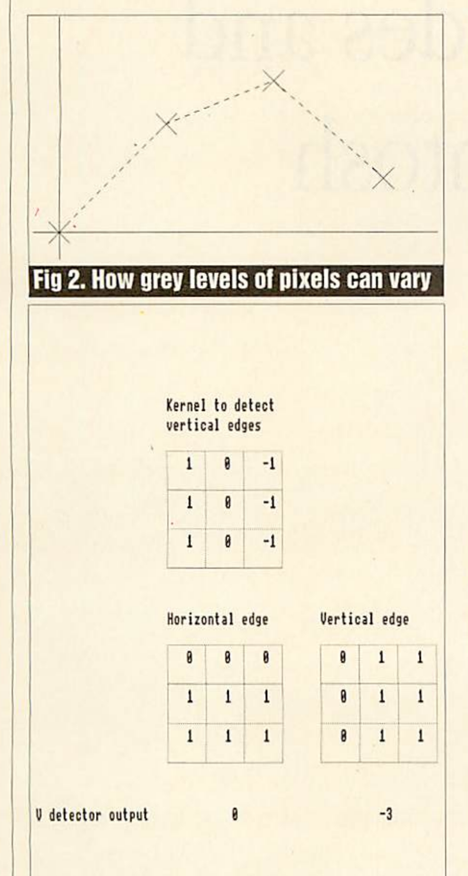


Fig 2. How grey levels of pixels can vary

Fig 4. Kernels for label checking

system, but this is counterbalanced by the system not having to be trained in each size of each font to be used.

The second program performs simple OCR on characters on-screen, using the straight comparison method: unsurprisingly, it manages 100 per cent accurate recognition, as the pixel patterns on-screen can be guaranteed to be the same as the templates.

Ketchup with technology

What on earth does image analysis have to do with tomato ketchup bottles? Well, it's used in the manufacturing process to see if the bottles' labels are on straight. Not exclusively for tomato ketchup, either: any industrial process that uses labelling can benefit from these methods.

In a typical bottling plant, bottles are held at top and bottom and whisked along past a machine which labels them, one that fills them and one that screws the lids on. Between the labelling and filling the label's position can be checked.

A typical image as seen by the camera is shown in figure 3. A few steps are followed to determine the straightness of the label:

● Find the left-hand edge of the bottle. Remember that the bottles are moving, and hence the edge of the bottle in the image may well not appear at the same place all of the time. Since the bottles are only moving horizontally, we can assume that the bottom edge is fixed.

● Check that the label is on in the right place. This can be done by making sure that the left-hand edge of the label is the correct distance from the left-hand edge of the bottle, and that the label's top is the correct distance up the bottle.

● Make sure it's not rotated. The position of one of the edges of the bottle is measured at a couple of points to do this; the difference between the two can be used to calculate the angle.

What features of the image are used to find these? Well, the place where background becomes bottle is marked by an edge in the image – it goes from white to grey. And the transition from bottle to label is similarly marked. So, if these edges are detected, the job is nearly done. Remember the first article on convolutions? Remember the edge detector? (There's a brief recap in figure 4 for those reprobates who missed it). The edge detector can be used to detect the position of the edge of the bottle for us, simply by moving the kernel to detect vertical edges along a horizontal line (a 'check-line') which goes over the edge. The position on that line at which the edge detector gives maximum output can be taken to be the position of the edge.

Once we have found the edge of the bottle, we then define three check-lines relative to it to find the label (see figure 5 for the image with the check-lines added). The vertical check-line lets us determine whether the label is at the correct vertical position on the bottle and the two horizontal ones let us work out both the horizontal position of the label and its rotation.

If the vertical edges found are at x1 and x2, then the edge of the label is at (x1+x2)/2 and its angle of rotation is 180*(x2-x1)/((y2-y1)*PI, where y2 and y1 are the y coordinates of the check-lines (only accurate if x2-x1 is small).

We can then see if the horizontal and vertical displacements and rotation are within acceptable limits and reject the bottle if they are not.

The third program with this article demonstrates this technique. The results are not absolutely accurate, of course – this is again due to the image being stored as pixels.

Next month: a look at mathematical image generation including Lissajous figures and various fractals.

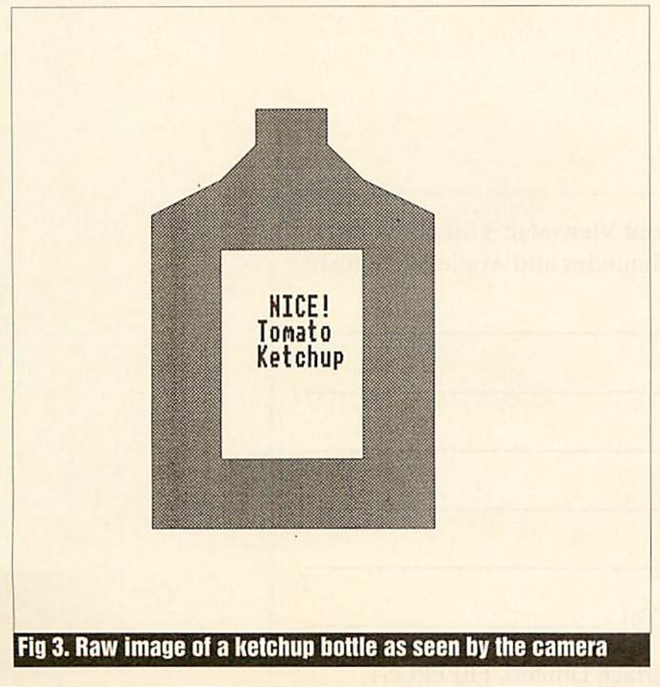


Fig 3. Raw image of a ketchup bottle as seen by the camera

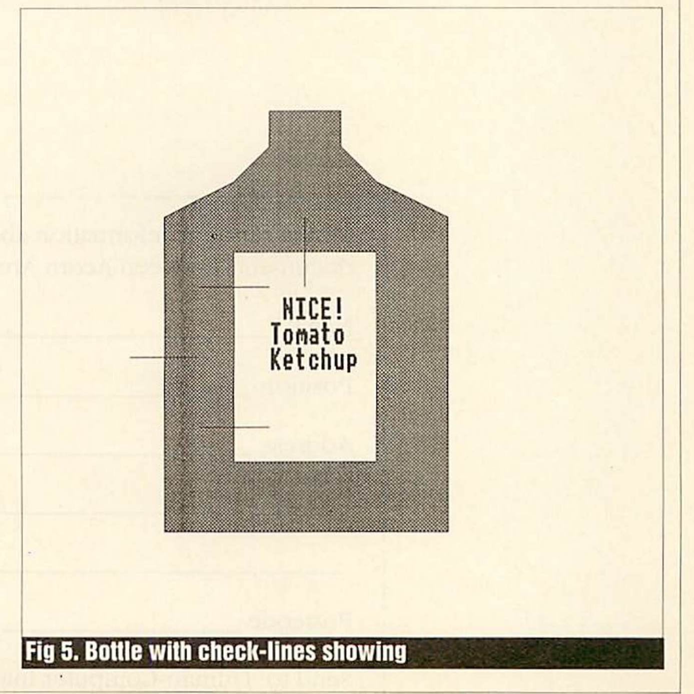


Fig 5. Bottle with check-lines showing

SPECIAL AGENT

For children with special educational needs, the BBC B has been a useful avenue for communication and self-expression. **CHRIS DRAGE** asks whether the Archimedes can successfully continue this tradition

The BBC B has proved to be an effective tool for children with special educational needs, enabling control of the computer via a variety of input devices and communication and access to information that was previously impossible.

How well does the Archimedes series continue this tradition? Does a 32-bit Risc solution mean 'overkill' in situations that are successfully being met by the BBC B and Master 128 machines? This month and next I shall examine the role that Arcs can play in special needs education.

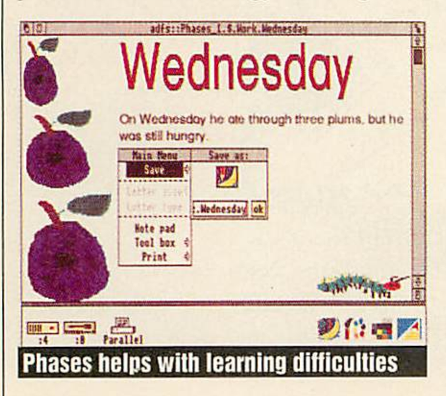
The four Semercs* – Bristol, Redbridge, Manchester and Newcastle – were the hub of hardware and software for special education until their demise at the end of March 1989, when their roles were devolved to the local education authorities. In reality, this meant only those authorities with either sufficient funding or interest could provide a structure for continuing special needs development.

Oldham LEA committed itself early on to providing support through the Northwest (ex-Manchester) Semerc. During the past year the Northwest Semerc and NCET** have published a variety of materials available as Blue Files, which may be bought ready-prepared at a nominal price.

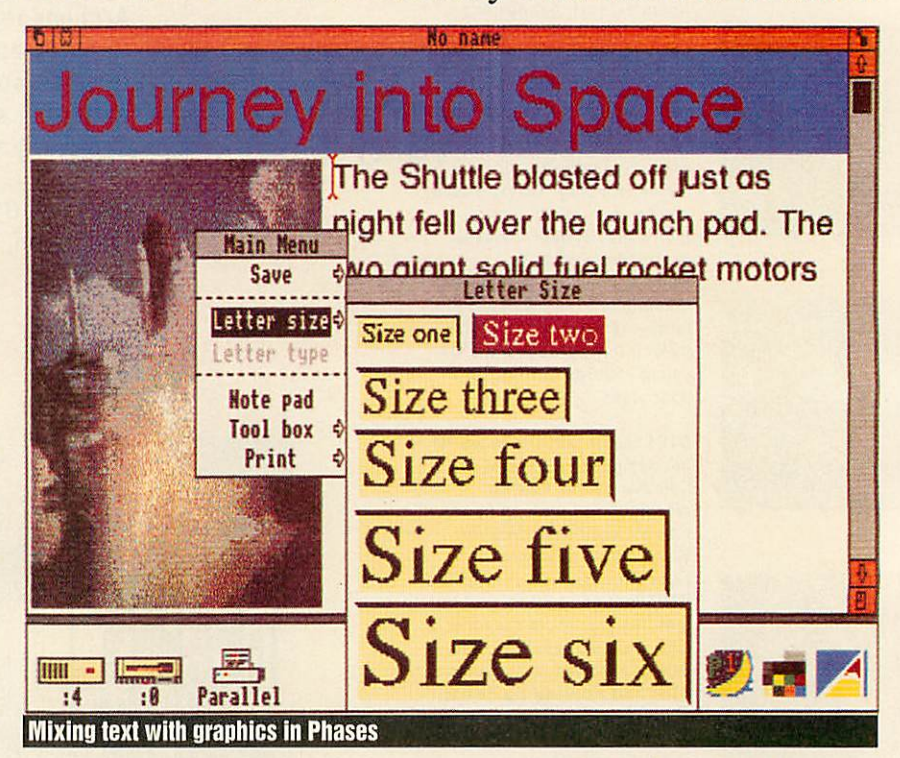
The fact that the Northwest Semerc has some 43 Blue File titles alone, and last year distributed 42,000 discs of special needs software, testifies to the success of this consortium. With 17 LEAs now subscribing to the Semerc's services, it arguably represents the main thrust of IT development in the area of special needs. So how does the Northwest Semerc view the role of the Archimedes?

Director Martin Littler clearly approves of 32-bit Risc technology and he sees the improved speed, memory capacity and graphical capabilities of the Archimedes series as prime reasons for its suitability for people with disabilities and handicaps.

He says, 'It meets the user more than halfway, offering a friendly and supportive environment. It removes the pupil and the teacher a welcome step away from the complexities of the technology, allowing them to concentrate on the learning task.'



Phases helps with learning difficulties



Mixing text with graphics in Phases

He also cites the fact that, whereas with the model B purchasers had to buy separate versions for different input devices, the Archimedes' version requires only one copy of the software, loading any necessary input device/screen modules to suit each pupil's individual needs.

Before an A3000, A310 or A400 series machine can be used with various input devices, it requires expanding in several ways. Table 1 outlines some combinations. Unfortunately there is, as yet, no provision for including a touchscreen.

With the implementation of the Warnock Report's conclusions, all schools face the task of integrating into the mainstream those pupils who were formerly placed in special schools or remedial departments for reasons of mental or physical handicap or social, educational or emotional deprivation.

The task of preparing the ordinary classroom teacher in primary and secondary schools to cope with this situation involves a level of training and support that still has not yet been achieved in many schools. To spearhead help in this area the Northwest Semerc has introduced *Phases*, a series of programs which is designed to support the child with special needs in the mainstream environment.

Phase#1 is the first of a family of wordprocessing programs to be 'phased' in and it includes a number of features that users of *Caption*, *Folio* and *FP Extra* have frequently asked for: easily created graphics screens, variable sized text and the ability to pop pictures into the text area.

Input device	Expansion required A310/400 series	A3000	Supplier
Mouse	none	none	Supplied with Arc
Trackerball	none	none	Technomatic
Delta Cat	none	none	Voltmace
Concept Keyboard	I/O podule	User/analogue	Acorn & HCCS/Morley*
Micro Mike	I/O podule	User/analogue	Acorn & HCCS/Morley*
Switches	I/O podule	User/analogue	Acorn & HCCS/Morley*
Switch access box	none	none	NW SEMERC

* Supplied by Acorn for the A310/400, HCCS/Morley for the A3000

Table 1. Special needs add-ons

It is basically a type-in and print-out wordprocessor which aims to be easier to use than any of the above programs, yet combines the best features of each.

Particularly exciting is the ability to pick up a coloured sprite from a directory, drop it onto a page of text and watch the writing flow around the picture to make an attractive illustrated story, description or poem.

Similarly, drop a border onto the page and the text squeezes nicely inside it. A library of borders and graphics is under way which should encourage children to work in all areas of the curriculum.

Martin Littler hopes that a library of support materials will grow to provide a versatile introductory combined wordprocessor and DTP package for those tackling key stages 1 and 2 (including secondary special educational needs).

Suitably sophisticated

Phases is very suitable for children with moderate learning difficulties, including the visually impaired. It has a wide choice of text and screen colours and print sizes. *Phases#1* multi-tasks and can work with spelling checkers, thesauruses (for instance *Keyword*) and Concept Keyboard utilities.

When all the *Phases* family is in place its total cost will be in the region of £40 to £50, comparable with both Archimedes *Folio* and *Pendown Plus*. However, that is where the comparison ends as these wordprocessors offer many more features and are more sophisticated.

But the Northwest Semerc's involvement with the Archimedes does not stop there. Five popular eight-bit packages are now running on the Arc under emulation.

The 11 Allan Nixon Keyboard Programs use either the keyboard or Concept Keyboard for input. The activities range from number and letter recognition games to Snap and simple mazes and puzzles. Frequently, there is the option for the teacher to create new versions of the game. A4 and A3 overlays are provided.

The very popular *Infant Disc* (originally in MEP's *Infant Pack*) has been converted for use with the Archimedes. This suite of five programs has also been modified for use with the Concept Keyboard. Again both A4 and A3 overlays come with the pack.

Lists, another Alan Nixon package, is an ideal starting point for data handling. It is a friendly program that guides children through creating, saving and using datafiles.

Moving In was also very popular as an eight-bit program. In fact, it was voted second out of the 50 programs in the Northwest Semerc's own software survey published in January. The child is offered an empty five-room house with the front removed. The aim is to place furniture, household objects and people in any of the rooms. As the child enters instructions the rooms change accordingly.

There is an option to use Concept Keyboard input at three levels of difficulty. A 'completed' house can be printed out or saved to disc for further modification later. The package includes two overlays suitable for use with *Phase#1*.

Sid and Mike is a suite of five programs for use with the Micro Mike voice input device. It aims to motivate children to experiment vocally and should encourage those who are reluctant to vocalise. Simple animation effects can be controlled by making sounds into the Micro Mike.

To make use of this software, an A3000 requires a user port/analogue port internal podule, while a 400 series computer needs Acorn's I/O Podule.

Despite the above examples, it would be a mistake to assume that the Semerc's only occupation is software publication. It is heavily engaged in in-service training and hardware/software research and development. It also publishes a regular special needs newsletter called *Copy* which is full of interesting case studies and reviews of how people are coping with new computers like the Archimedes.

One fundamental fact that should be remembered is that special needs software can be effectively used in a variety of other areas of the school and home. In my family both *Sid and Mike* and the *Blob* programs from Widgit Software have proved very successful with my two-year old.

The reverse is similarly true. As we shall see next month, even sophisticated computer games, such as those from Fourth Dimension, have a role to play for those suffering physical disabilities. It is a question of looking at childrens' particular needs and examining the software closely to ascertain whether it can meet those needs.

The Northwest Semerc software survey identifies 90 useful software packages. However, it is significant and indicative of how special needs education is served by the computer industry when, out of the 90, 17 run on the RM Nimbus; one runs on the Apple Macintosh; a handful run on the Archimedes series; and the vast majority run on the BBC B/Master 128.

Offering alternatives

These statistics are disappointing for anyone wishing to give learners access to powerful new machines. The good old Beeb had a wealth of different sockets into which a wide variety of input devices could be attached. According to Semerc's survey document, 'It is as if the British computer industry has forgotten that children benefit from alternatives to the Qwerty keyboard. If the new machines support these devices at all it is through expensive and/or unobtainable extra ports and podules.'

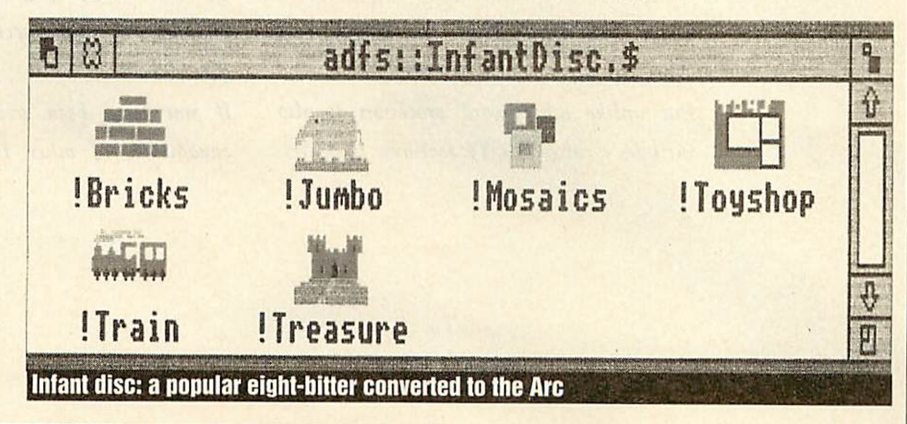
However, the situation is rapidly changing, especially for Archimedes and A3000 users. Next month I will look at a number of useful software packages which, together with suitable input devices, are helping to equip children with special needs with a better range of learning resources.

The programs will all be on show at the Northwest Semerc's Micros for Special Needs Exhibition at Oldham in October.

Phase#1 £10, Allan Nixon Keyboard Programs £3.50, Infant Disc £5.50, Lists £3.50, Moving In £5.50 and Sid and Mike £3.50 from Northwest Semerc, Fitton Hill CDC, Rosary Road, Oldham OL8 2QE.

** Semerc – Special Education Micro Electronics Resource Centre. The Northwest Semerc is at Fitton Hill Curriculum Centre, Rosary Road, Oldham OL8 2QE. Tel: 061-627 4469*

*** NCET – National Council for Educational Technology. Tel: (0203) 416994.*



Infant disc: a popular eight-bitter converted to the Arc

A completely new, reduced feature, version of the popular Impression DTP program. Designed for those who want the best in word processing and who want to take the first steps into DTP.

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Enhanced word processing features mean that at last there is a program that goes beyond First Word Plus.



Enhanced word processing

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But unlike other word processors it also includes a range of DTP features.

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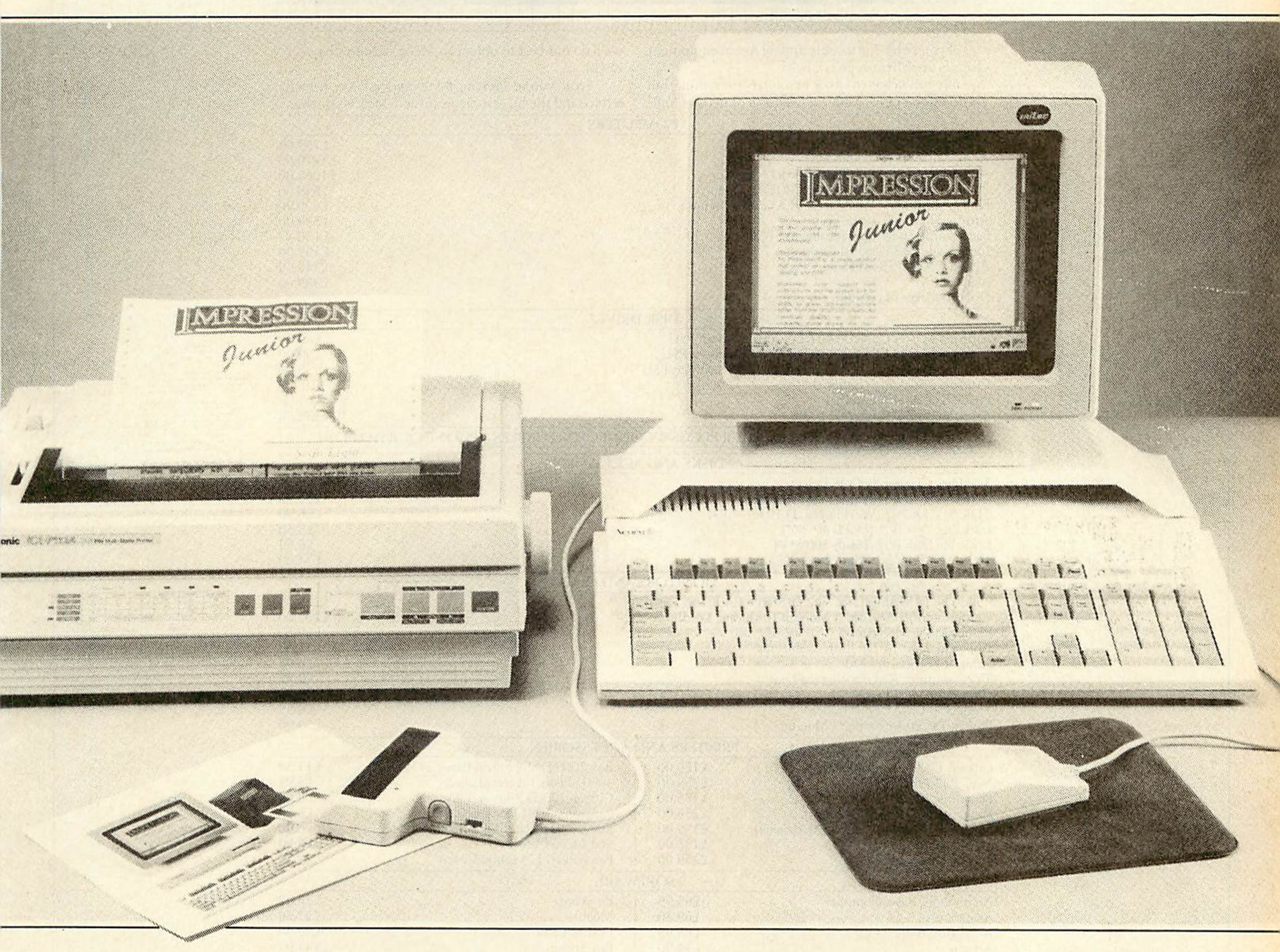
Other features

Upgradeable to Impression: Junior owners can upgrade to the full blown Impression for the difference in price, at any time • File compatible with Impression - documents saved with Impression Junior are directly loadable into other versions • Fully RISC OS compatible with direct links to !Draw, !Paint & other applications • Ideal for 1Mbyte machine owners • No hardware protection.

The manual includes a step-by-step introduction to Impression Junior. The tutorials take you, from scratch, through creating simple letters, multi-page documents and typical DTP type pages. The package also includes the highly acclaimed 'DTP at a glance' book.

If you have been overwhelmed by the capabilities of other DTP programs, or

enhanced word processing



simply don't require all the powerful features these may provide, then Impression Junior is the answer. And remember it is part of a family of products so that as your experience grows and your requirements evolve there is always a version of Impression to suit.

There can never be one single product that caters for all word processing and DTP requirements, and so Impression Junior has been created specifically for those new to DTP or those who want to take their word processing one step further.

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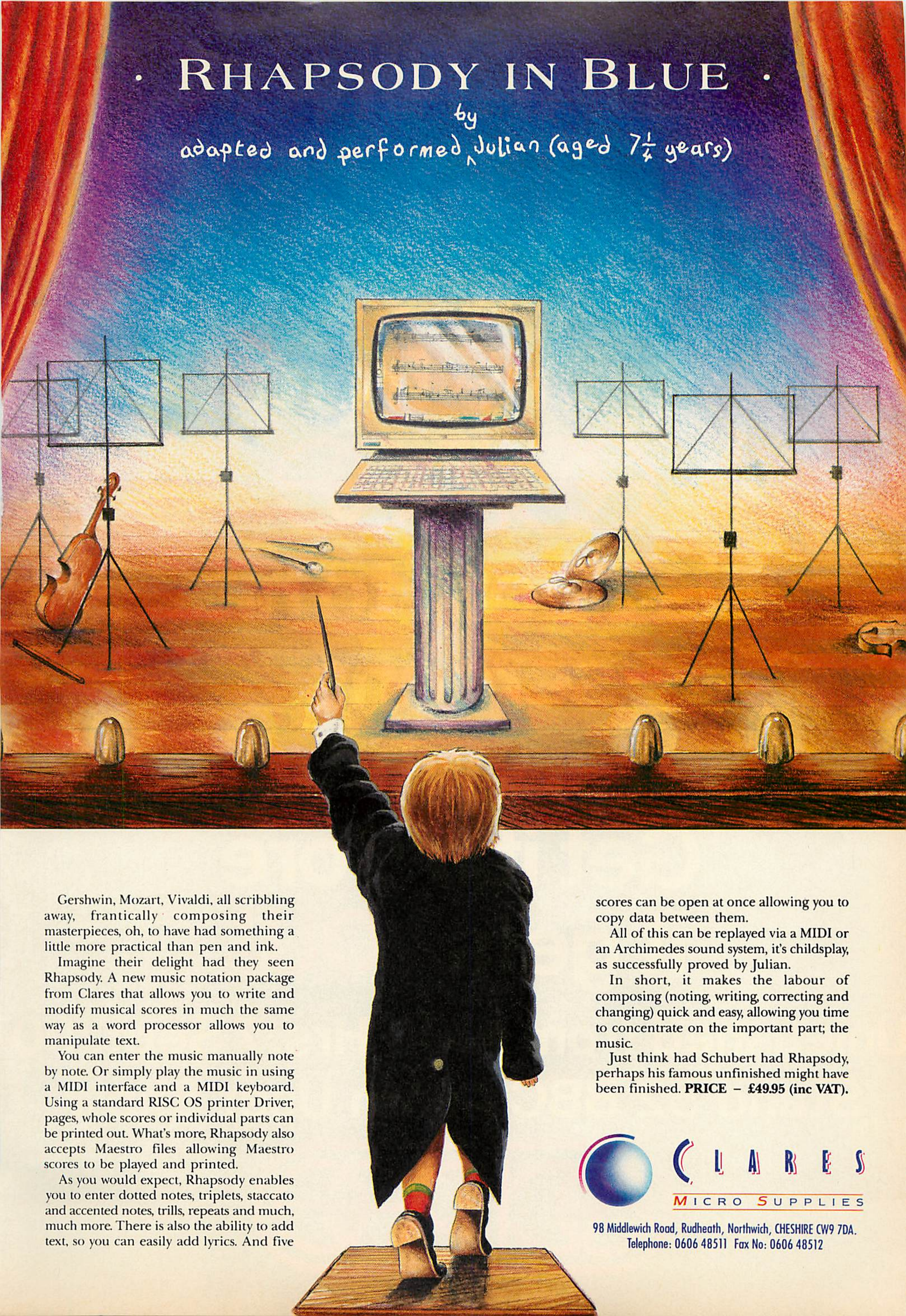
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COMPATIBILITY

Program	Page	BBC B	B+/128	Master 128	Master Compact	Electron	Arc	6502SP/ Turbo	ADFS	Econet	Shadow Ram	Monthly Disc
Risc Revue	57											
Listing 1							■		■	■	■	■
Listing 2							■		■	■	■	■
Listing 3							■		■	■	■	■
Listing 4							■		■	■	■	■
Listing 5							■		■	■	■	■
Eight Bits	59											
Listing 1		■	■	■	■	■	■	■	■	■	■	■
Listing 2				■	■		■		■	■	■	■
Listing 3		■	■	■	■	■		■			■	■
Listing 4		■	■	■	■	■		■			■	■
Ray Tracing	65											
Listing 1		■	■	■	■	■		■	■	■	■	■
Listing 2							■		■	■	■	■
!Stretch	72						■		■	■	■	■
Arm Programming	74						■		■	■	■	■
Image Processing	79	■	■	■	■	■	■	■	■	■	■	■

RISC REVUE

Listing 1

```
   10 REM >!RunImage (RR1)
   20 REM Changing the pointer demo
   30 REM By Joe Abley
   40 REM for Archimedes only
   50 REM (c) BAU September 1990
   60 :
   70 DIM task% 4,block% 512,main% 200,i
nd% 64
   80 $task%="TASK"
   90 SYS "Wimp_Initialise",200,!task%,"
PtrDemo" TO task_handle%
  100 :
  110 ON ERROR PROCerror(TRUE):END
  120 SYS "Wimp_OpenTemplate",,"<ptrdemo
$dir>.Templates"
  130 SYS "Wimp_LoadTemplate",,main%,ind
%,ind%+64,-1,"main",0
  140 SYS "Wimp_CreateWindow",,main% TO
main_handle%
  150 SYS "Wimp_CloseTemplate"
  160 !block%=main_handle%
  170 SYS "Wimp_GetWindowState",,block%
  180 SYS "Wimp_OpenWindow",,block%
  190 ON ERROR PROCerror(FALSE)
  200 own%=TRUE
  210 mask%=%1000000110010000011
  220 finished%=FALSE
  230 WHILE NOT finished%
  240 SYS "Wimp_Poll",mask%,block% TO re
ason%
  250 CASE reason% OF
  260 WHEN 2:SYS "Wimp_OpenWindow",,bloc
k%
  270 WHEN 3:SYS "Wimp_CloseWindow",,blo
ck%:finished%=TRUE
  280 WHEN 4:PROCdefault_pointer
  290 WHEN 5:IF !block%=main_handle% THE
N PROCmy_pointer
  300 WHEN 17,18
  310 CASE block%!16 OF
  320 WHEN 0:finished%=TRUE
  330 WHEN &400C1:IF own% THEN PROCmy_po
inter
  340 ENDCASE
  350 ENDCASE
  360 ENDWHILE
  370 SYS "Wimp_CloseDown",task_handle%,
!task%
  380 END
  390 :
  400 DEF PROCerror(fatal%)
  410 PROCdefault_pointer
  420 SYS "Wimp_DragBox",,0
  430 !block%=ERR
  440 $(block%+4)=REPORT$+" (internal er
ror code "+STR$ERL+")"
  450 SYS "Wimp_ReportError",block%,1,"P
ointer Demo"
  460 IF fatal% THEN
  470 SYS "Wimp_CloseDown",task_handle%,
!task%
  480 ENDIF
  490 ENDPROC
  500 :
  510 DEF PROCdefault_pointer
  520 *pointer 1
  530 own%=FALSE
  540 ENDPROC
  550 :
  560 DEF PROCmy_pointer
  570 SYS "Wimp_SpriteOp",36,1,"ptr_cros
s",2,8,5,0,0
  580 own%=TRUE
  590 ENDPROC
```

Listing 2

```
   10 REM >MakeApp (RR2)
   20 REM Create !PtrDemo data files
   30 REM Original files by Joe Abley
   40 REM for Archimedes only
   50 REM (c) BAU September 1990
   60 :
   70 free%=(HIMEM-END-&8000) AND &FFFFF
000
   80 DIM w% free%
   90 READ app$
  100 REPEAT
  110 PROCins(app$)
  120 INPUT"Enter destination directory:
 "app$
  130 IF app$="" app$="@"
  140 SYS "XOS_File",5,app$ TO type%
  150 UNTIL type%=2
  160 REPEAT
  170 READ file$
  180 IF file$<>"*" THEN
  190 file$=app$+"."+file$
  200 PRINT"Creating file """file$""""
  210 READ load%,exec%,olen%,attrib%
  220 p%=0
  230 d$=""
  240 dl%=1
  250 WHILE p%<olen%
  260 b%=FNb
  270 IF b%=130:p%?w%=FNb:p%+=1
  280 IF b%>=131 AND b%<=162 THEN
  290 n%=b%-128
  300 f%=p%-FNb
  310 FOR i%=0 TO n%-1
  320 ?(w%+p%+i%)=?(w%+f%+i%)
  330 NEXT
  340 p%+=n%
  350 ENDIF
  360 IF b%<130 OR b%>162 THEN
  370 p%?w%=b%:p%+=1
  380 ENDIF
  390 ENDWHILE
  400 SYS "OS_File",0,file$,,,w%,w%+p%
  410 SYS "OS_File",1,file$,load%,exec%,
,attrib%
  420 ENDIF
  430 UNTIL file$="*"
  440 PRINT'"Files created"
  450 END
  460 :
  470 DEF FNb
  480 LOCAL b%,c1%,c2%,i%
  490 IF d$="" THEN
  500 READ d$,c1%
  510 c2%=0
  520 FOR i%=1 TO LEN(d$)/2
  530 c2%+=EVAL("&"+MID$(d$,2*i%-1,2))
  540 NEXT
  550 IF c1%<>(c2% MOD 100) PRINT"Error
in DATA line ";dl%:END
  560 dl%+=1
  570 ENDIF
  580 b%=EVAL("&"+LEFT$(d$,2))
  590 d$=MID$(d$,3)
  600 =b%
  610 :
  620 DEF PROCins(i$)
  630 LOCAL i%
  640 FOR i%=1 TO LEN(i$)
  650 SYS "OS_Byte",138,0,ASC(MID$(i$,i%
))
  660 NEXT
  670 ENDPROC
  680 :
  690 DATA !PtrDemo
  700 DATA "!Sprites"
  710 DATA &FFFFF942,&48A58E54
  720 DATA &2CC,&3
  730 DATA 02000000108304D083094C,77
  740 DATA 830D2170747264656D6F83,71
  750 DATA 170003871C840C0783282C,55
  760 DATA 832C3C0100000C83347782,80
  770 DATA 9E77829979E98297829782,6
  780 DATA 9E7782878288F8830F8299,85
  790 DATA 8297D97979798299798297,46
  800 DATA 77778288828F0000FF8298,14
  810 DATA 82997DDD7E778299829982,70
  820 DATA 99798287F8828883107882,50
  830 DATA 9E7D77DDEE7E7777829782,36
  840 DATA 997777841077D77777DD77,51
  850 DATA 829E829979F78288842082,99
  860 DATA 8878777D8411EE77778287,90
  870 DATA 088674D07783228433858 3,97
  880 DATA 7077E7832177EDEEE77E86,11
  890 DATA 10EEEEDE7777D7EEEEEE87,16
  900 DATA 20E7EE7E7DD7844584AB84,3
  910 DATA A2831E7D7DD7EE862F84D0,47
  920 DATA E78433ED7E87208510EE83,62
  930 DATA 33866000077077834D8A21,98
  940 DATA 077EE7835377884207EEEE,82
  950 DATA E7839177DD83C683A08378,18
  960 DATA EE835083A383568962896B,39
  970 DATA 9012FF8F238310F08C1484,74
  980 DATA 20FF8F25F09011FF8F2283,31
  990 DATA 218E58FFFF0F8E420F9078,75
 1000 DATA F08E219299A021924296FD,22
 1010 DATA 7483FF7074725F63726F73,78
 1020 DATA 7383FD0183FF0887FF840C,28
 1030 DATA 2C83FD83048614A8AA85FA,38
 1040 DATA 82A002022A84FF08000280,61
 1050 DATA 84FA0283FF830400AA2A82,47
 1060 DATA A0AA880C84148820883087,17
 1070 DATA 4000,64
 1080 DATA "Templates"
 1090 DATA &FFFFEC42,&48974544
 1100 DATA &A2,&3
 1110 DATA FFFFFFFF0000000830485,88
 1120 DATA 072C830D7683110183156D,23
 1130 DATA 61696E0D8B1DAC83295083,48
 1140 DATA 19F4030000B8028A368444,50
 1150 DATA 120003FF0702070103010C,9
 1160 DATA 864FFC835805865A3D844D,83
 1170 DATA 308654846C5887341E8779,67
 1180 DATA 5468652041 6D617A696E67,32
 1190 DATA 204368616E678409506F69,50
 1200 DATA 6E74657221 0D,87
 1210 DATA *
```

Listing 3

```
   10 REM >Powers (RR3)
   20 REM by A Reysenbach
   30 REM for Archimedes only
   40 REM (c) BAU September 1990
   50 :
   60 MODE 0
   70 CLS
   80 INPUT"Number? "numb%
   90 PRINT
  100 INPUT"Raise to what power? "exp%
  110 IF numb%<2 OR numb%>199526131 OR e
xp%<2 THEN END
  120 log=LOG(numb%)
  130 dupnumb%=numb%
  140 dupexp%=exp%
  150 len%=exp%*(log+.000000002)+1
  160 DIM fig%(len%)
  170 fig%(1)=1
  180 begin%=1
  190 carry%=0
  200 speedup%=8.3/log
  210 IF speedup%>exp% THEN speedup%=1
  220 rest%=exp% MOD speedup%
  230 numb%=numb%^speedup%
  240 exp%=exp%/speedup%
  250 PROCraise
  260 IF rest%<>0 THEN
```

Continued ▶

RISC REVUE

◀ Continued

```
 270 numb%=dupnumb%
 280 begin%=dupexp%-rest%+1
 290 exp%=dupexp%
 300 PROCraise
 310 ENDIF
 320 CLS
 330 PRINT STR$(dupnumb%);" ^ ";dupexp%
;" is exactly"
 340 PRINT
 350 @%=1
 360 FOR F%=len% TO 1 STEP -1
 370 PRINT fig%(F%);
 380 NEXT
 390 PRINT''"(which is about ";fig%(len
%);" x 10^";STR$(len%-1);")"
 400 END
 410 :
 420 DEF PROCraise
 430 FOR raise%=begin% TO exp%
 440 FOR place%=1 TO raise%*(LOG(numb%)
+.000000002)+1
 450 help%=numb%*fig%(place%)+carry%
 460 fig%(place%)=help% MOD 10
 470 carry%=help% DIV 10
 480 NEXT
 490 NEXT
 500 ENDPROC
```

Listing 4

```
  10 REM >FastLife (RR4)
  20 REM by Andrew Smith
  30 REM for Archimedes only
  40 REM (c) BAU September 1990
  50 :
  60 MODE 0
  70 OFF
  80 VDU 19,0,16,0,0,150
  90 DIM code% &5000,i 8
 100 !i=149:i!4=-1
 110 SYS "OS_ReadVduVariables",i,i
 120 scr%=!i
 130 FOR opt%=0 TO 2 STEP 2
 140 P%=code%
 150 index=0:offset=1
 160 cell=3:vote=4
 170 dummy=5
 180 zero=6:one=7
 190 base=8:scr=9
 200 byte=2
 210 x=11:y=12
 220 x1=6:y1=7
 230 gen=10
 240 [OPT opt%
 250 .blank
 260 MOV index,#8192
 270 ADR cell,cells
 280 ADD vote,cell,index
 290 MOV dummy,#0
 300 .loop
 310 STR dummy,[cell,index]
 320 STR dummy,[vote,index]
 330 SUBS index,index,#4
 340 BPL loop
 350 MOV pc,r14
 360 .life
 370 STMFD r13!,{r14}
 380 MOV base,#scr% AND &FFF00000
 390 ADD base,base,#scr% AND &FFFFF
 400 ADR cell,cells
 410 ADD vote,cell,#8192
 420 MOV gen,#0
 430 .mainloop
 440 MOV index,#8192
 450 SUB index,index,#4
 460 MOV x,#63
 470 MOV y,#31
 480 .loop1
 490 LDR dummy,[cell,index]
 500 CMP dummy,#1
 510 BLEQ votecode
 520 SUBS x,x,#1
 530 ADDMI x,x,#64
 540 SUBMI y,y,#1
 550 SUBS index,index,#4
 560 BPL loop1
 570 MOV zero,#0
 580 MOV one,#1
 590 MOV x,#63
 600 MOV y,#248
 610 MOV index,#8192
 620 SUB index,index,#4
 630 .loop5
 640 LDR dummy,[vote,index]
 650 CMP dummy,#0
 660 BEQ end
 670 CMP dummy,#4
 680 STREQ zero,[vote,index]
 690 BEQ end
 700 CMP dummy,#3
 710 STREQ zero,[vote,index]
 720 STREQ one,[cell,index]
 730 ADDEQ scr,base,y,LSL #4
 740 ADDEQ scr,scr,y,LSL #6
 750 ADDEQ scr,scr,x
 760 MOVEQ byte,#24
 770 STREQB byte,[scr],#80
 780 MOVEQ byte,#60
 790 STREQB byte,[scr],#80
 800 MOVEQ byte,#110
 810 STREQB byte,[scr],#80
 820 MOVEQ byte,#78
 830 STREQB byte,[scr],#80
 840 MOVEQ byte,#110
 850 STREQB byte,[scr],#80
 860 MOVEQ byte,#60
 870 STREQB byte,[scr],#80
 880 MOVEQ byte,#24
 890 STREQB byte,[scr],#80
 900 BEQ end
 910 STR zero,[vote,index]
 920 STR zero,[cell,index]
 930 MOV byte,#0
 940 ADD scr,base,y,LSL #4
 950 ADD scr,scr,y,LSL #6
 960 ADD scr,scr,x
 970 STRB byte,[scr],#80
 980 STRB byte,[scr],#80
 990 STRB byte,[scr],#80
1000 STRB byte,[scr],#80
1010 STRB byte,[scr],#80
1020 STRB byte,[scr],#80
1030 STRB byte,[scr],#80
1040 .end
1050 SUBS x,x,#1
1060 ADDMI x,x,#64
1070 SUBMI y,y,#8
1080 SUBS index,index,#4
1090 BPL loop5
1100 LDR byte,delay
1110 .delayloop
1120 SUBS byte,byte,#1
1130 BPL delayloop
1140 SWI &11F
1150 SWI &146
1160 SWI &119
1170 MOV r0,gen
1180 ADR r1,buffer
1190 MOV r2,#6
1200 SWI "OS_ConvertCardinal2"
1210 SWI "OS_Write0"
1220 ADD gen,gen,#1
1230 MOV r0,#&81
1240 MOV r1,#&C8
1250 MOV r2,#&FF
1260 SWI "OS_Byte"
1270 CMP r1,#&FF
1280 BNE off
1290 .pause
1300 MOV r1,#&C9
1310 MOV r2,#&FF
1320 SWI "OS_Byte"
1330 CMP r1,#&FF
1340 BNE pause
1350 .off
1360 MOV r1,#&CF
1370 MOV r2,#&FF
1380 SWI "OS_Byte"
1390 CMP r1,#&FF
1400 MOVEQ byte,#&10000
1410 STREQ byte,delay
1420 MOV r1,#&CE
1430 MOV r2,#&FF
1440 SWI "OS_Byte"
1450 CMP r1,#&FF
1460 MOVEQ byte,#&8000
1470 STREQ byte,delay
1480 MOV r1,#&EE
1490 MOV r2,#&FF
1500 SWI "OS_Byte"
1510 CMP r1,#&FF
1520 MOVEQ byte,#0
1530 STREQ byte,delay
1540 MOV r1,#&EF
1550 MOV r2,#&FF
1560 SWI "OS_Byte"
1570 CMP r1,#&FF
1580 BNE mainloop
1590 LDMFD r13!,{pc}
1600 .delay
1610 EQUD 0
1620 .buffer
1630 EQUD 0
1640 EQUD 0
1650 .votecode
1660 MOV x1,x
1670 MOV y1,y
1680 ADD x1,x1,#1
1690 CMP x1,#64
1700 SUBGE x1,x1,#64
1710 ADD y1,y1,#1
1720 CMP y1,#32
1730 SUBGE y1,y1,#32
1740 MOV offset,y1,LSL #8
1750 ADD offset,offset,x1,LSL #2
1760 LDR dummy,[vote,offset]
1770 ADD dummy,dummy,#1
1780 STR dummy,[vote,offset]
1790 SUBS x1,x1,#1
1800 ADDMI x1,x1,#64
1810 MOV offset,y1,LSL #8
1820 ADD offset,offset,x1,LSL #2
1830 LDR dummy,[vote,offset]
1840 ADD dummy,dummy,#1
1850 STR dummy,[vote,offset]
1860 SUBS x1,x1,#1
1870 ADDMI x1,x1,#64
1880 MOV offset,y1,LSL #8
1890 ADD offset,offset,x1,LSL #2
1900 LDR dummy,[vote,offset]
1910 ADD dummy,dummy,#1
1920 STR dummy,[vote,offset]
1930 SUBS y1,y1,#1
1940 ADDMI y1,y1,#32
1950 ADD x1,x1,#2
1960 CMP x1,#64
1970 SUBGE x1,x1,#64
1980 MOV offset,y1,LSL #8
1990 ADD offset,offset,x1,LSL #2
2000 LDR dummy,[vote,offset]
2010 ADD dummy,dummy,#1
2020 STR dummy,[vote,offset]
2030 SUBS x1,x1,#1
2040 ADDMI x1,x1,#64
2050 MOV offset,y1,LSL #8
2060 ADD offset,offset,x1,LSL #2
2070 LDR dummy,[vote,offset]
2080 ADD dummy,dummy,#1
2090 STR dummy,[vote,offset]
2100 SUBS x1,x1,#1
2110 ADDMI x1,x1,#64
2120 MOV offset,y1,LSL #8
2130 ADD offset,offset,x1,LSL #2
2140 LDR dummy,[vote,offset]
2150 ADD dummy,dummy,#1
2160 STR dummy,[vote,offset]
2170 SUBS y1,y1,#1
2180 ADDMI y1,y1,#32
2190 ADD x1,x1,#2
2200 CMP x1,#64
2210 SUBGE x1,x1,#64
2220 MOV offset,y1,LSL #8
2230 ADD offset,offset,x1,LSL #2
2240 LDR dummy,[vote,offset]
2250 ADD dummy,dummy,#1
2260 STR dummy,[vote,offset]
2270 SUBS x1,x1,#1
2280 ADDMI x1,x1,#64
2290 MOV offset,y1,LSL #8
2300 ADD offset,offset,x1,LSL #2
2310 LDR dummy,[vote,offset]
2320 ADD dummy,dummy,#1
2330 STR dummy,[vote,offset]
2340 SUBS x1,x1,#1
2350 ADDMI x1,x1,#64
2360 MOV offset,y1,LSL #8
2370 ADD offset,offset,x1,LSL #2
2380 LDR dummy,[vote,offset]
2390 ADD dummy,dummy,#1
2400 STR dummy,[vote,offset]
2410 MOV pc,r14
2420 ]
2430 cells=P%
2440 votes=P%+8192
2450 NEXT
2460 REPEAT
2470 CLS
2480 CALLblank
2490 PROCedit
2500 VDU 28,64,31,79,0,17,129,17,0,12,2
6
2510 PRINTTAB(69,3);"LIFE"
2520 PRINTTAB(66,6);"P - Pause"
2530 PRINTTAB(66,8);"O - Resume"
2540 PRINTTAB(66,10);"Q - Quit"
2550 PRINTTAB(66,12);"1 - Slow"
2560 PRINTTAB(66,14);"2 - Medium"
2570 PRINTTAB(66,16);"3 - Fast"
2580 PRINTTAB(67,24);"Generation"
2590 CALL life
2600 PRINTTAB(30,15)" Again ? (Y/N)"
2610 REPEAT
2620 c=GET
2630 UNTIL c=89 OR c=78
2640 COLOUR 1:COLOUR 128:CLS
2650 UNTIL c=78
2660 END
2670 :
2680 DEF PROCedit
2690 *POINTER
2700 SYS "OS_Byte",106,&81
2710 VDU 12,28,64,31,79,0,17,129,17,0,1
2,26
2720 VDU 23,255,24,60,110,78,110,60,24,
0
2730 PRINTTAB(69,3)"LIFE"
2740 PRINTTAB(68,6)"Editing.."
2750 PRINTTAB(65,9)"Use mouse to"
2760 PRINTTAB(65,11)"move cursor."
2770 PRINTTAB(65,13)"Select - Sets"
2780 PRINTTAB(65,15)"Adjust - Clears"
2790 PRINTTAB(65,17)"Menu   - Starts"
2800 PRINTTAB(67,20)"R - Random"
2810 PRINTTAB(67,23)"C - Blank"
2820 PRINTTAB(67,25);"Q - Quit"
2830 MOUSE RECTANGLE 0,0,1022,1020
2840 COLOUR 1:COLOUR 128
2850 REPEAT
2860 MOUSE x%,y%,b%
2870 POINT TO ((x% DIV 16)*16)+8,((y% D
IV 32)*32)+16
2880 IF INKEY-52 THEN
2890 SYS "OS_Byte",106,&80
2900 COLOUR 0:COLOUR 129
2910 PRINTTAB(65,20);"Return to start"
2920 COLOUR 1:COLOUR 128
2930 REPEAT
2940 WAIT
2950 x%=RND(64)-1:y%=RND(32)-1
2960 !(cells+x%*4+y%*256)=1
2970 VDU 31,x%,y%,255
2980 UNTIL INKEY-74
2990 b%=2
3000 ENDIF
3010 IF INKEY-17 THEN CLS:PRINTTAB(35,1
5);"GOODBYE!!":dummy=GET:END
3020 IF INKEY-83 THEN
3030 CALL blank
3040 VDU 28,0,31,63,0,12
3050 ENDIF
3060 y%=1023-y%
3070 IF b%=4 THEN
3080 !(cells+(x% DIV 16)*4+(y% DIV 32)*
256)=1
3090 VDU 31,x% DIV 16,y% DIV 32,255
3100 ENDIF
3110 IF b%=1 THEN
3120 !(cells+(x% DIV 16)*4+(y% DIV 32)*
256)=0
3130 VDU 31,x% DIV 16,y% DIV 32,32
3140 ENDIF
3150 UNTIL b%=2
3160 SYS "OS_Byte",106,&80
3170 ENDPROC
```

Additions to New Modes program from May 1990 RISC REVUE

```
  10 REM Mode Convertor
  20 REM Arc only
  30 REM (c)BAU Sep 1990
  40 :
  50 MODE 0:REM or 1 or 2
  60 OFF
  70 N%=OPENIN"FILENAME"
  80 GCOL 16,0
  90 FOR Y%=992 TO 0 STEP -32
 100 FOR X%=0 TO 1279 STEP 16
 110 VDU 23,2,BGET#N%,BGET#N%,BGET#N%,B
GET#N%,BGET#N%,BGET#N%,BGET#N%,BGET#N%
 120 RECTANGLE FILL X%,Y%,15,31
 130 NEXT X%,Y%
 140 CLOSE#N%
```

Listing 1

```
10 REM BBC Goblet
20 REM by Malcolm Dolman and Rob Miller
30 REM for B/B+/M/C/E/A
40 REM (c) BAU May 1990
50 :
60 MODE 0
70 VDU 19,7,6
80 VDU 23;8202;0;0;0;
90 VDU 29,640;0;
100 nshades=12
110 step=(360/(2*nshades))
120 :
130 PROCcylinder(70,220,80,220,1)
140 PROCcylinder(80,220,100,200,1)
150 PROCcylinder(100,200,150,20,1)
160 PROCcylinder(150,30,450,30,1)
170 :
180 FOR R=180 TO 90 STEP -10
190 ew1=SINRAD(R)*250:ew2=SINRAD(R+10)*250
200 eh1=COSRAD(R)*250:eh2=COSRAD(R+10)*250
210 PROCcylinder(eh1+700,ew1,eh2+700,ew2,2)
220 NEXT R
230 :
240 PROCcylinder(700,250,900,225,2)
250 PROCcylinder(900,225,900,215,3)
260 :
270 END
280 :
290 DEF PROCcylinder(eh1,ew1,eh2,ew2,pal)
300 :
310 RESTORE 630
320 FOR D = -90 TO (270-step) STEP step
330 READ n1,n2,n3,n4,n5,n6,n7,n8
340 IF pal=3 RESTORE 630
350 IF pal=2 AND D<90 THEN 360 ELSE 380
360 VDU 23,2,255-n1,255-n2,255-n3,255-n4,255-n5,255-n6,255-n7,255-n8
370 GOTO 390
380 VDU 23,2,n1,n2,n3,n4,n5,n6,n7,n8
390 GCOL 16,0
400 :
410 h1 = ew1/4:h2 = ew2/4
420 x1 = SINRAD(D)*ew1
430 y1 = (COSRAD(D)*h1)+eh1
440 x2 = SINRAD(D+step)*ew1
450 y2 = (COSRAD(D+step)*h1)+eh1
460 x3 = SINRAD(D)*ew2
470 y3 = (COSRAD(D)*h2)+eh2
480 x4 = SINRAD(D+step)*ew2
490 y4 = (COSRAD(D+step)*h2)+eh2
500 :
510 PROCquad(x1,y1,x2,y2,x3,y3,x4,y4)
520 NEXT D
530 :
540 ENDPROC
550 :
560 DEF PROCquad(x1,y1,x2,y2,x3,y3,x4,y4)
570 MOVE x3,y3
580 MOVE x1,y1
590 PLOT 85,x4,y4
600 PLOT 85,x2,y2
610 ENDPROC
620 :
630 DATA 255,255,255,255,255,255,255,255
640 DATA 223,251,127,239,253,191,247,254
650 DATA 239,189,247,189,239,189,247,189
660 DATA 119,221,119,221,119,221,119,221
670 DATA 115,221,55,221,115,221,55,221
680 DATA 174,213,186,87,234,93,171,117
690 DATA 204,51,204,51,204,51,204,51
700 DATA 81,42,69,168,21,162,84,138
710 DATA 140,34,200,34,140,34,200,34
720 DATA 136,34,136,34,136,34,136,34
730 DATA 16,66,8,66,16,66,8,66
740 DATA 16,1,64,4,16,1,64,4
750 DATA 16,1,64,4,16,1,64,4
760 DATA 16,66,8,66,16,66,8,66
770 DATA 136,34,136,34,136,34,136,34
780 DATA 140,34,200,34,140,34,200,34
790 DATA 81,42,69,168,21,162,84,138
800 DATA 204,51,204,51,204,51,204,51
810 DATA 174,213,186,87,234,93,171,117
820 DATA 115,221,55,221,115,221,55,221
830 DATA 119,221,119,221,119,221,119,221
840 DATA 239,189,247,189,239,189,247,189
850 DATA 223,251,127,239,253,191,247,254
860 DATA 255,255,255,255,255,255,255,255
```

Listing 2

```
10 REM 3D Colour Goblets
20 REM by Malcolm Dolman and Rob Miller
30 REM for M/C only
40 REM (c) BAU Sep 90
50 :
60 MODE 1
70 VDU 19,2,4,0,0,0
80 VDU 19,3,2,0,0,0
90 VDU 23;8202;0;0;0;
100 VDU 23,2,245,250,245,250,245,250,245,250
110 GCOL 16,128
120 VDU 16
130 VDU 23,2,90,165,90,165,90,165,90,165
140 GCOL 16,0
150 MOVE 0,600
160 PLOT 101,1279,0
170 FOR M = 8 TO 10
180 P = M^2/100
190 IF M=8 THEN VDU 29,210;290;
200 IF M=9 THEN VDU 29,590;148;
210 IF M=10 THEN VDU 29,1010;0;
220 nshades=8
230 step=(360/(2*nshades))
240 :
250 PROCcylinder(70,220,80,220,1)
260 PROCcylinder(80,220,100,200,1)
270 PROCcylinder(100,200,150,20,1)
280 PROCcylinder(150,30,450,30,1)
290 :
300 FOR R=180 TO 90 STEP -10
310 ew1=SINRAD(R)*250:ew2=SINRAD(R+10)*250
320 eh1=COSRAD(R)*250:eh2=COSRAD(R+10)*250
330 PROCcylinder(eh1+700,ew1,eh2+700,ew2,2)
340 NEXT R
350 :
360 PROCcylinder(700,250,840,225,2)
370 PROCcylinder(840,225,840,215,3)
380 :
390 NEXT M
400 END
410 :
420 DEF PROCcylinder(eh1,ew1,eh2,ew2,pal)
430 IF M=8 THEN RESTORE 820
440 IF M=9 THEN RESTORE 980
450 IF M=10 THEN RESTORE 1140
460 FOR D = -90 TO (270-step) STEP step
470 IF M=8 AND pal=2 AND D=-90 THEN RESTORE 900
480 IF M=9 AND pal=2 AND D=-90 THEN RESTORE 1060
490 IF M=10 AND pal=2 AND D=-90 THEN RESTORE 1220
500 IF M=8 AND pal=2 AND D=90 THEN RESTORE 900
510 IF M=9 AND pal=2 AND D=90 THEN RESTORE 1060
520 IF M=10 AND pal=2 AND D=90 THEN RESTORE 1220
530 IF M=8 AND pal=3 THEN RESTORE 890
540 IF M=9 AND pal=3 THEN RESTORE 1050
550 IF M=10 AND pal=3 THEN RESTORE 1210
560 READ n1,n2,n3,n4,n5,n6,n7,n8
570 VDU 23,2,n1,n2,n3,n4,n5,n6,n7,n8
580 GCOL 16,0
590 :
600 h1 = ew1*M/40:h2 = ew2*M/40
610 x1 = SINRAD(D)*ew1*M/10
620 y1 = (COSRAD(D)*h1*P)+eh1*M/10
630 x2 = SINRAD(D+step)*ew1*M/10
640 y2 = (COSRAD(D+step)*h1*P)+eh1*M/10
650 x3 = SINRAD(D)*ew2*M/10
660 y3 = (COSRAD(D)*h2*P)+eh2*M/10
670 x4 = SINRAD(D+step)*ew2*M/10
680 y4 = (COSRAD(D+step)*h2*P)+eh2*M/10
690 :
700 PROCquad(x1,y1,x2,y2,x3,y3,x4,y4)
710 NEXT D
720 :
730 ENDPROC
740 :
750 DEF PROCquad(x1,y1,x2,y2,x3,y3,x4,y4)
760 MOVE x3,y3
770 MOVE x1,y1
780 PLOT 85,x4,y4
790 PLOT 85,x2,y2
800 ENDPROC
810 :
820 DATA 136,0,34,0,136,0,34,0
830 DATA 136,34,136,34,136,34,136,34
840 DATA 34,51,136,204,34,51,136,204
850 DATA 204,51,204,51,204,51,204,51
860 DATA 51,119,204,221,51,119,204,221
870 DATA 119,221,119,221,119,221,119,221
880 DATA 119,255,221,255,119,255,221,255
890 DATA 255,255,255,255,255,255,255,255
900 DATA 255,255,255,255,255,255,255,255
910 DATA 119,255,221,255,119,255,221,255
920 DATA 119,221,119,221,119,221,119,221
930 DATA 51,119,204,221,51,119,204,221
940 DATA 204,51,204,51,204,51,204,51
950 DATA 34,51,136,204,34,51,136,204
960 DATA 136,34,136,34,136,34,136,34
970 DATA 136,0,34,0,136,0,34,0
980 DATA 8,0,2,0,8,0,2,0
990 DATA 8,2,8,2,8,2,8,2
1000 DATA 2,3,8,12,2,3,8,12
1010 DATA 12,3,12,3,12,3,12,3
1020 DATA 3,7,12,13,3,7,12,13
1030 DATA 7,13,7,13,7,13,7,13
1040 DATA 7,15,13,15,7,15,13,15
1050 DATA 15,15,15,15,15,15,15,15
1060 DATA 15,15,15,15,15,15,15,15
1070 DATA 7,15,13,15,7,15,13,15
1080 DATA 7,13,7,13,7,13,7,13
1090 DATA 3,7,12,13,3,7,12,13
1100 DATA 12,3,12,3,12,3,12,3
1110 DATA 2,3,8,12,2,3,8,12
1120 DATA 8,2,8,2,8,2,8,2
1130 DATA 8,0,2,0,8,0,2,0
1140 DATA 64,0,16,0,64,0,16,0
1150 DATA 64,16,64,16,64,16,64,16
1160 DATA 48,64,192,16,48,64,192,16
1170 DATA 192,48,192,48,192,48,192,48
1180 DATA 48,112,192,208,48,112,192,208
1190 DATA 112,208,112,208,112,208,112,208
1200 DATA 112,240,208,240,112,240,208,240
1210 DATA 240,240,240,240,240,240,240,240
1220 DATA 240,240,240,240,240,240,240,240
1230 DATA 112,240,208,240,112,240,208,240
1240 DATA 112,208,112,208,112,208,112,208
1250 DATA 48,112,192,208,48,112,192,208
1260 DATA 192,48,192,48,192,48,192,48
1270 DATA 48,64,192,16,48,64,192,16
1280 DATA 64,16,64,16,64,16,64,16
1290 DATA 64,0,16,0,64,0,16,0
```

Listing 3

```
10 REM *PASSCAT
20 REM by Mark Lomas
30 REM for B/B+/E/M/C with DFS
40 REM (c) BAU Sep 90
50 FOR pass=0 TO 3 STEP 3
60 P%=&900
61 :
70 [OPT pass
80 .start
90 LDX #0
100 .loop
110 LDA drive,X
120 JSR &FFE3
130 INX
140 CPX #6
150 BNE loop
160 JSR &FFE0
170 STA &72
180 JMP cat
181 :
190 .setuptrap
200 LDA &20E
210 STA &70
220 LDA &20F
230 STA &71
240 LDA #print MOD256
250 STA &20E
260 LDA #print DIV 256
270 STA &20F
280 RTS
281 :
290 .cleartrap
300 LDA &70
310 STA &20E
320 LDA &71
330 STA &20F
340 RTS
341 :
350 .print
360 CMP #21
370 BNE printchar
380 LDA #ASC"*"
390 JMP printchar
391 :
400 .printchar
410 JMP (&70)
420 :
430 .cat
440 JSR setuptrap
450 LDA &72
460 STA catdrive
470 LDX #catstring MOD 256
480 LDY #catstring DIV 256
490 JSR &FFF7
500 JSR cleartrap
510 RTS
511 :
520 .drive
530 EQUS "DRIVE?"
540 EQUB 13
541 :
550 .catstring
560 EQUS "CAT"
561 :
570 .catdrive
580 EQUB 0
590 EQUB 13
600 ]
610 NEXT
620 OSCLI("SAVE Passcat "+STR$~900+" "+STR$~P%+" "+STR$~start)
```

Listing 4

```
10 REM Disc Protecter/Unprotecter
20 REM by Mark Lomas
30 REM for B/B+/E/M/C with DFS
40 REM (c) BAU Sep 90
50 :
60 ON ERROR PROCerror
70 MODE 7
80 PROCmenu
90 PROCread
100 PROCchange
110 PROCwrite
120 PROCmessage
130 END
140 :
150 DEF PROCmenu
160 CLS
170 PRINT TAB(9)"Disc Pro/unprotector"
180 PRINT TAB(8,1)STRING$(22,"=")
190 INPUT'' "1..PROTECT..2..UNPROTECT: "G%
200 REPEAT
210 INPUT''"ENTER DRIVE: "drive%
220 UNTIL drive%>=0 AND drive%<=3
230 PRINT''"GO (Y/N)?";
240 G$=GET$
250 IF G$<>"Y" THEN PROCmenu
260 ENDPROC
270 :
280 DEFPROCread
290 rewr%=&53
300 PROCdef
310 PROCcall(ctrl,10)
320 ENDPROC
330 :
340 DEFPROCdef
350 ctrl=&70
360 ctrl?0=drive%
370 ctrl!1=&800
380 ctrl?5=3
390 ctrl?6=rewr%
400 ctrl?7=0
410 ctrl?8=0
```

Continued ▶

EIGHT BITS

◀ Continued

```
420 ctrl?9=&21
430 ENDPROC
440 :
450 DEFPROCwrite
460 rewr%=&4B
470 PROCdef
480 PROCcall(ctrl,1Ø)
490 ENDPROC
500 :
510 DEFPROCcall(C%,end%)
520 LOCAL A%,X%,Y%,R%
530 A%=&7F
540 X%=C%
550 Y%=X%DIV 256
560 REPEAT
570 R%=R%+1
580 CALL &FFF1
590 UNTIL C%?end%=Ø OR R%=1Ø
600 IF C%?end%=Ø ENDPROC
610 ENDPROC
620 :
630 DEFPROCchange
640 IF G%=1 THEN $&BØØ=("Secret!"+CHR$21)
650 IF G%=2 $&BØØ=STRING$(7,CHR$Ø)
660 ENDPROC
670 :
680 DEFPROCmessage
690 IF G%=2 THEN PRINT''"Code 21 removed from" ELSE PRINT''"Code 21 placed on"
700 PRINT"drive ";drive%
710 ENDPROC
720 :
730 DEFPROCerror
740 CLS
750 REPORT:PRINT " at line ";ERL
760 END
```

RAY TRACING

Listing 1

```
   1Ø REM Raytracer
   2Ø REM by Richard Browning
   3Ø REM B/B+/M/C/E
   4Ø REM (c) BBC Acorn User September 1990
   5Ø :
   6Ø *K.Ø OSCLI"TAPE":D%=PA.-&EØØ:F.I%=PA. TO TOP+4 ST. 4:!(I%-D%)=!I%:N.:PA.=&EØØ|M
   7Ø MODE 2
   8Ø PROCia
   9Ø VDU29,64Ø;512;
  1ØØ ja=8ØØ
  11Ø ka=3ØØØ:la=3Ø:ma=Ø
  12Ø na=34ØØ:oa=5ØØ:pa=Ø:qa=6:ra=2*PI
  13Ø PROCsa(-1,Ø,2):ta=ua:va=wa:xa=ya
  14Ø FOR za%=-3ØØ TO 3ØØ STEP 8
  15Ø FOR _a%=-4ØØ TO 4ØØ STEP 4
  16Ø ab=la:bb=ka:cb=ma:db=Ø:eb=1
  17Ø fb%=Ø
  18Ø PROCsa(za%,_a%,ja-ma)
  19Ø gb=ua:hb=wa:ib=ya
  2ØØ jb=FNkb(ua,wa,ya,ka,la,ma,1)
  21Ø IF jb>15 THEN jb=15
  22Ø GCOLØ,jb/2:PLOT69,za%,_a%
  23Ø NEXT
  24Ø END
  25Ø :
  26Ø DEF FNlb
  27Ø IF mb>=Ø THEN =Ø
  28Ø nb=ABS((-5ØØ-ab)/mb)
  29Ø ob=ABS((pb*nb)+bb):qb=ABS((rb*nb)+cb)
  3ØØ IF ob>1E6 OR qb>1E6 THEN =Ø
  31Ø tb=ob MOD 1279:ub=qb MOD 1Ø23
  32Ø =1Ø+3*(tb<64Ø)+3*(ub<512)
  33Ø :
  34Ø DEF FNkb(pb,mb,rb,vb,wb,xb,yb)
  35Ø db=db+1:IF db>6 THEN PRINTTAB(Ø,Ø);"Iteration Limit!!":=Ø
  36Ø LOCAL zb,_b,ac,bb,ab,cb,bc,cc,dc
  37Ø LOCAL ec,fc,gc,hc,ic,jc,kc,lc,mc,rc
  38Ø RESTORE 214Ø:nc=1ØØØØØ:cc=yb
  39Ø zb=pb:_b=mb:ac=rb:bb=vb:ab=wb:cb=xb:mc=FALSE
  4ØØ REPEAT
  41Ø READ oc
  42Ø IF oc=1 THEN IF FNpc THEN mc=TRUE
  43Ø IF oc=2 THEN IF FNqc THEN mc=TRUE
  44Ø UNTIL oc=-1
  45Ø IF NOT mc THEN =FNlb
  46Ø bc=kc
  47Ø IF (lc AND 1) THEN bc=FNrc(kc)
  48Ø IF (lc AND 2) THEN bc=bc+FNsc(kc)
  49Ø IF (lc AND 4) THEN bc=bc+FNtc(kc)
  5ØØ IF (lc AND 8) THEN bc=bc+FNuc(cc,vc)
  51Ø IF (lc AND 16) THEN bc=bc+dc
  52Ø =bc
  53Ø :
  54Ø DEF FNwc(xc,yc,zc)
  55Ø _c=xc*xc+yc*yc+zc*zc
  56Ø IF _c<ad THEN bd=TRUE ELSE bd=FALSE
  57Ø cd=xc*zb+yc*_b+zc*ac
  58Ø IF (NOT bd) THEN IF cd<Ø THEN GOTO 63Ø
  59Ø dd=ad-_c+cd*cd
  6ØØ IF dd<=Ø THEN GOTO 63Ø
  61Ø IF bd THEN ed=cd+SQR(dd) ELSE ed=cd-SQR(dd)
  62Ø =TRUE
  63Ø =FALSE
  64Ø :
  65Ø DEF FNpc
  66Ø READ fd,gd,hd,id,bc,jd
  67Ø IF (jd AND 8)=8 THEN READ vc
  68Ø ad=id*id
  69Ø IF NOT(FNwc(fd-bb,gd-ab,hd-cb)) THEN =FALSE
  7ØØ IF ed>nc THEN =FALSE
  71Ø IF bd AND (jd AND 8)=8 THEN vc=1
  72Ø nc=ed:kc=bc:lc=jd
  73Ø hc=bb+zb*ed:ic=ab+_b*ed:jc=cb+ac*ed
  74Ø PROCsa(hc-fd,ic-gd,jc-hd)
  75Ø ec=ua:fc=wa:gc=ya
  76Ø IF (jd AND 16) THEN dc=dc+FNkd(1,ec,fc,gc)
  77Ø =TRUE
  78Ø :
  79Ø DEF FNqc
  8ØØ READ ld,md,nd,od,bc,jd
  81Ø IF (jd AND 48) THEN READ pd,qd,rd,sd,td,ud,vd,wd,xd,yd,zd,_d
  82Ø IF NOT(FNae(ld,md,nd,od)) THEN =FALSE
  83Ø IF ed>nc THEN =FALSE
  84Ø be=ab+_b*ed:IF ABS(be)>5ØØ THEN =FALSE
  85Ø kc=bc:lc=jd
  86Ø hc=bb+zb*ed:ic=be:jc=cb+ac*ed
  87Ø IF ce>Ø THEN ld=-ld:md=-md:nd=-nd
  88Ø PROCsa(ld,md,nd)
  89Ø ec=ua:fc=wa:gc=ya
  9ØØ IF (jd AND 48) THEN nd=FNkd(2,hc,ic,jc)
  91Ø IF nd<Ø THEN =FALSE ELSE dc=nd
  92Ø nc=ed
  93Ø =TRUE
  94Ø :
  95Ø DEF FNae(ld,md,nd,od)
  96Ø ce=FNde(ld,md,nd,zb,_b,ac)
  97Ø IF ce=Ø THEN =FALSE
  98Ø ee=-(FNde(ld,md,nd,bb,ab,cb)+od)
  99Ø ed=ee/ce
 1ØØØ IF ed<Ø THEN =FALSE
 1Ø1Ø =TRUE
 1Ø2Ø :
 1Ø3Ø DEF FNrc(fe)
 1Ø4Ø PROCsa(na-hc,oa-ic,pa-jc)
 1Ø5Ø ge=FNde(ua,wa,ya,ec,fc,gc)
 1Ø6Ø IF ge<Ø THEN =Ø
 1Ø7Ø he=fe+qa*Ø.5*ge
 1Ø8Ø =he
 1Ø9Ø :
 11ØØ DEF FNsc(ie)
 111Ø je=hc-na:ke=ic-oa:le=jc-pa
 112Ø PROCsa(je,ke,le)
 113Ø PROCme(ec,fc,gc,ua,wa,ya)
 114Ø ne=FNde(oe,pe,qe,ec,fc,gc)
 115Ø re=FNde(oe,pe,qe,-zb,-_b,-ac)
 116Ø IF re<Ø THEN =Ø
 117Ø se=SQR(je*je+ke*ke+le*le)
 118Ø te=ie+ABS(6ØØØ/(se+2Ø))*(Ø.5*ne+2*(re^6Ø))
 119Ø =te
 12ØØ :
 121Ø DEF FNtc(kc)
 122Ø PROCme(ec,fc,gc,zb,_b,ac)
 123Ø hb=pe:gb=oe:ib=qe
 124Ø =FNkb(oe,pe,qe,hc+ec,ic+fc,jc+gc,cc)
 125Ø :
 126Ø DEF FNuc(eb,ue)
 127Ø fb%+=1
 128Ø IF bd THEN ge=FNde(zb,_b,ac,ec,fc,gc) ELSE ge=FNde(-zb,-_b,-ac,ec,fc,gc)
 129Ø ve=eb/ue
 13ØØ we=(1+((ve*ve)*((ge*ge)-1)))
 131Ø IF we<Ø THEN =Ø
 132Ø xe=((ve*ge)-SQRwe)
 133Ø ye=ve*zb+xe*ec:ze=ve*_b+xe*fc:_e=ve*ac+xe*gc
 134Ø PROCsa(ye,ze,_e)
 135Ø =FNkb(ua,wa,ya,hc+ua,ic+wa,jc+ya,ue)
 136Ø :
 137Ø DEF FNkd(ed,tb,ub,af)
 138Ø IF ed=1 THEN =FNbf(tb,ub,af)
 139Ø IF ed=2 THEN =FNcf(tb,ub,af)
 14ØØ =Ø
 141Ø :
 142Ø DEF FNbf(tb,ub,af)
 143Ø df=ACS(FNde(-tb,-ub,-af,Ø,1,Ø))
 144Ø we=df/PI
 145Ø IF we=1 OR we=Ø THEN ef=Ø:GOTO 15ØØ
 146Ø ff=FNde(ta,va,xa,tb,ub,af)/SINdf:IF ff<-1 THEN ff=-1 ELSE IF ff>1 THEN ff=1
 147Ø ne=ACS(ff)/ra
 148Ø PROCgf(Ø,1,Ø,ta,va,xa)
 149Ø IF FNde(hf,if,jf,tb,ub,af)>Ø THEN ef=ne ELSE ef=1-ne
 15ØØ =FNkf(ef,we)
 151Ø :
 152Ø DEF FNcf(tb,ub,af)
 153Ø lf=pd-sd+vd-yd:mf=qd-td+wd-zd:nf=rd-ud+xd-_d
 154Ø of=sd-pd:pf=td-qd:qf=ud-rd
 155Ø rf=yd-pd:sf=zd-qd:tf=_d-rd
 156Ø uf=pd:vf=qd:wf=rd
 157Ø PROCgf(lf,mf,nf,ec,fc,gc):xf=hf:yf=if:zf=jf
 158Ø PROCgf(rf,sf,tf,ec,fc,gc):_f=hf:ag=if:bg=jf
 159Ø cg=FNde(_f,ag,bg,uf,vf,wf)
 16ØØ dg=FNde(xf,yf,zf,uf,vf,wf)+FNde(_f,ag,bg,of,pf,qf)
 161Ø eg=FNde(xf,yf,zf,of,pf,qf)
 162Ø IF eg=Ø THEN GOTO 166Ø
 163Ø fg=2*eg:gg=xf/fg:hg=yf/fg:ig=zf/fg
 164Ø jg=-dg/fg:kg=cg/eg:lg=-_f/eg:mg=-ag/eg:ng=-bg/eg
 165Ø GOTO 168Ø
 166Ø ef=(FNde(_f,ag,bg,tb,ub,af)-cg)/(dg-FNde(xf,yf,zf,tb,ub,af))
 167Ø IF ef>=Ø AND ef<=1 THEN GOTO 172Ø ELSE =-1
 168Ø og=jg+FNde(gg,hg,ig,tb,ub,af):pg=kg+FNde(lg,mg,ng,tb,ub,af)
 169Ø qg=og*og-pg:IF qg<Ø THEN =-1
 17ØØ qg=SQRqg:ef=og-qg:IF ef>=Ø AND ef<=1 THEN GOTO 172Ø
 171Ø ef=og+qg:IF ef<Ø OR ef>1 THEN =-1
 172Ø PROCgf(of,pf,qf,ec,fc,gc):rg=hf:sg=if:tg=jf
 173Ø ug=FNde(rg,sg,tg,uf,vf,wf)
 174Ø vg=FNde(xf,yf,zf,uf,vf,wf)+FNde(rg,sg,tg,rf,sf,tf)
 175Ø wg=FNde(xf,yf,zf,rf,sf,tf)
 176Ø IF wg=Ø THEN GOTO 18ØØ
 177Ø xg=2*wg:yg=xf/xg:zg=yf/xg:_g=zf/xg
 178Ø ah=-vg/xg:bh=ug/wg:ch=-rg/wg:dh=-sg/wg:eh=-tg/wg
 179Ø GOTO 182Ø
 18ØØ we=(FNde(rg,sg,tg,tb,ub,af)-ug)/(vg-FNde(xf,yf,zf,tb,ub,af))
 181Ø IF we>=Ø AND we<=1 THEN GOTO 186Ø ELSE =-1
 182Ø og=ah+FNde(yg,zg,_g,tb,ub,af):pg=bh+FNde(ch,dh,eh,tb,ub,af)
 183Ø qg=og*og-pg:IF qg<Ø THEN =-1
 184Ø qg=SQRqg:we=og-qg:IF we>=Ø AND we<=1 THEN GOTO 186Ø
 185Ø we=og+qg:IF we<Ø OR we>1 THEN =-1
 186Ø =FNkf(ef,we)
 187Ø :
 188Ø DEF PROCgf(pb,mb,rb,vb,wb,xb)
 189Ø hf=(mb*xb-rb*wb):if=(rb*vb-xb*pb):jf=(pb*wb-vb*mb)
 19ØØ ENDPROC
 191Ø DEFFNde(fh,gh,hh,ih,jh,kh)
 192Ø =fh*ih+gh*jh+hh*kh
 193Ø DEFPROCme(lh,mh,nh,oh,ph,qh)
 194Ø ge=FNde(lh,mh,nh,oh,ph,qh)
 195Ø PROCsa(oh-2*ge*lh,ph-2*ge*mh,qh-2*ge*nh)
 196Ø oe=ua:pe=wa:qe=ya
 197Ø ENDPROC
 198Ø :
 199Ø DEF PROCsa(rh,sh,th)
 2ØØØ uh=SQR(rh*rh+sh*sh+th*th)
 2Ø1Ø ua=rh/uh:wa=sh/uh:ya=th/uh
 2Ø2Ø ENDPROC
 2Ø3Ø :
 2Ø4Ø DEF FNkf(ef,we)
 2Ø5Ø U%=1279-ef*1279:V%=1Ø23-we*1Ø23
 2Ø6Ø =15*SINRADU%+15*COSRADV%
 2Ø7Ø :
 2Ø8Ø DEF PROCia
 2Ø9Ø FOR L%=Ø TO 7
 21ØØ READ C%:VDU19,L%,C%;Ø;Ø;Ø;
 211Ø NEXT
 212Ø DATA Ø,4,1,5,2,6,3,7
 213Ø ENDPROC
 214Ø DATA 2,Ø,1,Ø,2ØØ,Ø,48,28ØØ,-2ØØ,2ØØØ,24ØØ,-2ØØ,Ø,34ØØ,-2ØØ,Ø,32ØØ,-2ØØ,2ØØØ
 215Ø DATA 1,3ØØØ,2ØØ,8ØØ,2ØØ,Ø,6
 216Ø DATA -1,Ø,Ø,Ø,Ø,Ø
```

Listing 2

```
   10 REM >RayTrace
   20 REM by Richard Browning
   30 REM for Arc only
   40 REM (c) BBC Acorn User September 1990
   50 :
   60 MODE 12
   70 PROCsetpalette
   80 :
   90 REM ** The following is an example of loading a sprite for texture mapping
  100 REM ** Don't forget to specify the correct filename and also set
  110 REM ** SCREENSIZE to 160K at least
  120 REM SYS "OS_Byte",112,2
  130 REM *SCREENLOAD PICS.MPIC
  140 REM SYS "OS_Byte",112,1
  150 :
  160 VDU29,640;512;
  170 REM ** Screen position
  180 :
  190 Screen_z=800
  200 REM ** Viewer position
  210 :
  220 px=3500:py=30:pz=-200
  230 REM ** Light position
  240 :
  250 lightx=3400:lighty=500:lightz=0:lighti=6:TPI=2*PI
  260 REM ** Rotational parameters for sphere texture mapping
  270 :
  280 PROCnormalise(-1,0,2):Sex=Rd_x:Sey=Rd_y:Sez=Rd_z
  290 :
  300 FOR x%=-600 TO 600 STEP 2
  310 FOR y%=-400 TO 400 STEP 4
  320 :
  330 REM ** Initialise ray origin
  340 posy=py:posx=px:posz=pz:it=0:Si=1
  350 :
  360 REM ** Normalise ray vector
  370 PROCnormalise(x%,y%,Screen_z-pz)
  380 rx=Rd_x:ry=Rd_y:rz=Rd_z
  390 :
  400 REM ** Call the tracer
  410 pixel=FNtrace(Rd_x,Rd_y,Rd_z,px,py,pz,1)
  420 :
  430 IF pixel>15 THEN pixel=15
  440 GCOL0,pixel:POINT x%,y%
  450 :
  460 NEXT,
  470 NEXT
  480 END
  490 :
  500 REM ** The ol' tartan floor
  510 :
  520 DEF FNfloor
  530 IF y1>=0 THEN =0
  540 ratio=ABS((-500-posy)/y1)
  550 xpos=ABS((x1*ratio)+posx):zpos=ABS((z1*ratio)+posz)
  560 IF xpos>1E6 OR zpos>1E6 THEN =0
```

Continued ▶

◀ Continued

```
570 x=xpos MOD 1279:y=zpos MOD 1023
580 =6+3*(x<640)+2*(y<512)
590 :
600 DEF FNtrace(x1,y1,z1,x2,y2,z2,ir)
610 it+=1:IF it>6 THEN PRINTTAB(0,0);"Iteration Limit!!":=0
620 LOCAL cray_x,cray_y,cray_z,posx,posy,posz,col,ind_refrac,ctex
630 LOCAL xnv,ynv,znv,xhit,yhit,zhit,hitcol,surface,hit,intersec_dist
640 RESTORE 3270:intersec_dist=100000:ind_refrac=ir
650 cray_x=x1:cray_y=y1:cray_z=z1:posx=x2:posy=y2:posz=z2:hit=FALSE
660 :
670 REM ** Check for object intersection
680 REPEAT
690 READ type
700 IF type=1 THEN IF FNsphere THEN hit=TRUE
710 IF type=2 THEN IF FNplane THEN hit=TRUE
720 UNTIL type=-1
730 IF NOT hit THEN =FNfloor
740 :
750 REM ** Ray hit object, so call other routines depending on
760 REM ** <SURFACE> parameter
770 col=hitcol
780 REM ** Matt
790 IF (surface AND 1) THEN col=FNdiff(hitcol)+RND(1)-0.5
800 REM ** Shiny
810 IF (surface AND 2) THEN col=col+FNspec(hitcol)+RND(1)-0.5
820 REM ** Mirror
830 IF (surface AND 4) THEN col=col+FNmirror(hitcol)
840 REM ** Opaque
850 IF (surface AND 8) THEN col=col+FNopaque(ind_refrac,rir)
860 REM ** Texture-Mapped
870 IF (surface AND 16) THEN col=col+ctex
880 =col
890 :
900 DEF FNhit_sphere(OC_x,OC_y,OC_z)
910 REM ** Find the ray to the centre and its length squared
920 L2oc=OC_x*OC_x+OC_y*OC_y+OC_z*OC_z
930 REM ** If inside sphere then record that fact
940 IF L2oc<Sr2 THEN inside_sphere=TRUE ELSE inside_sphere=FALSE
950 REM ** Now calculate closest approach
960 Tca=OC_x*cray_x+OC_y*cray_y+OC_z*cray_z
970 REM ** Test if pointing away from sphere centre
980 IF (NOT inside_sphere) THEN IF Tca<0 THEN GOTO 1060
990 REM ** Calculate half-chord distance
1000 T2hc=Sr2-L2oc+Tca*Tca
1010 REM ** If ray misses sphere then continue with loop
1020 IF T2hc<=0 THEN GOTO 1060
1030 REM ** Intersection distance
1040 IF inside_sphere THEN t=Tca+SQR(T2hc) ELSE t=Tca-SQR(T2hc)
1050 =TRUE
1060 =FALSE
1070 :
1080 DEF FNsphere
1090 READ Sphere_x,Sphere_y,Sphere_z,Sr,col,stype
1100 IF (stype AND 8)=8 THEN READ rir
1110 Sr2=Sr*Sr
1120 REM ** Does ray hit the sphere?
1130 IF NOT(FNhit_sphere(Sphere_x-posx,Sphere_y-posy,Sphere_z-posz)) THEN =FALSE
1140 REM ** And is it nearest to ray origin?
1150 IF t>intersec_dist THEN =FALSE
1160 REM If leaving sphere then ind. refr. =1
1170 IF inside_sphere AND (stype AND 8)=8 THEN rir=1
1180 REM ** Continue and save distance for future comparison along with
1190 REM ** any other attributes which may need to be added later,
1200 REM ** e.g. surface type (diffract, reflect) etc
1210 REM ** and reflection/refraction vectors
1220 REM ** For all these, use GLOBAL variables for accessibility
1230 intersec_dist=t:hitcol=col:surface=stype
1240 xhit=posx+cray_x*t:yhit=posy+cray_y*t:zhit=posz+cray_z*t
1250 PROCnormalise(xhit-Sphere_x,yhit-Sphere_y,zhit-Sphere_z)
1260 xnv=Rd_x:ynv=Rd_y:znv=Rd_z
1270 IF (stype AND 16) THEN ctex=FNtmap(1,xnv,ynv,znv)
1280 =TRUE
1290 :
1300 DEF FNplane
1310 READ A,B,C,D,col,stype
1320 IF (stype AND 48) THEN READ P00x,P00y,P00z,P10x,P10y,P10z,P11x,P11y,P11z,P01x,P01y,P01z
1330 REM ** Does ray hit the plane?
1340 IF NOT(FNhit_plane(A,B,C,D)) THEN =FALSE
1350 REM ** And is it nearest to ray origin?
1360 IF t>intersec_dist THEN =FALSE
1370 yint=posy+cray_y*t:IF ABS(yint)>500 THEN =FALSE
1380 hitcol=col:surface=stype
1390 xhit=posx+cray_x*t:yhit=yint:zhit=posz+cray_z*t
1400 IF vd>0 THEN A=-A:B=-B:C=-C
1410 PROCnormalise(A,B,C)
1420 xnv=Rd_x:ynv=Rd_y:znv=Rd_z:C=0
1430 IF (stype AND 48) THEN C=FNtmap(2,xhit,yhit,zhit)
1440 IF (stype AND 48) AND C<0 THEN =FALSE ELSE ctex=ctex+C
1450 intersec_dist=t
1460 =TRUE
1470 :
1480 DEF FNhit_plane(A,B,C,D)
1490 vd=FNdot(A,B,C,cray_x,cray_y,cray_z)
1500 REM ** Just where is ray/normal pointing?
1510 IF vd=0 THEN =FALSE
1520 v0=-(FNdot(A,B,C,posx,posy,posz)+D)
1530 t=v0/vd
1540 IF t<0 THEN =FALSE
1550 =TRUE
1560 :
1570 REM ** Used only outside program sequence
1580 :
1590 DEF PROCgetcoeffs(x1,y1,z1,x2,y2,z2,x3,y3,z3,x,y,z)
1600 A=.5*((z1+z2)*(y2-y1)+(z2+z3)*(y3-y2)+(z3+z1)*(y1-y3))
1610 B=.5*((z1+z2)*(x2-x1)+(z2+z3)*(x3-x2)+(z3+z1)*(x1-x3))
1620 C=.5*((y1+y2)*(x2-x1)+(y2+y3)*(x3-x2)+(y3+y1)*(x1-x3))
1630 D=-(A*x+B*y+C*z)
1640 ENDPROC
1650 :
1660 REM ** Controls the diffuse reflection of light
1670 :
1680 DEF FNdiff(Ccol)
1690 PROCnormalise(lightx-xhit,lighty-yhit,lightz-zhit)
1700 angle=FNdot(Rd_x,Rd_y,Rd_z,xnv,ynv,znv)
1710 IF angle<0 THEN =0
1720 colour=Ccol+lighti*0.5*angle
1730 =colour
1740 :
1750 REM ** Controls the specular reflection of light
1760 :
1770 DEF FNspec(Scol)
1780 lx=xhit-lightx:ly=yhit-lighty:lz=zhit-lightz
1790 PROCnormalise(lx,ly,lz)
1800 PROCrefl(xnv,ynv,znv,Rd_x,Rd_y,Rd_z)
1810 theta=FNdot(refl_x,refl_y,refl_z,xnv,ynv,znv)
1820 lambda=FNdot(refl_x,refl_y,refl_z,-cray_x,-cray_y,-cray_z)
1830 IF lambda<0 THEN =0
1840 l=SQR(lx*lx+ly*ly+lz*lz)
1850 c=Scol+ABS(6000/(l+20))*(0.5*theta+2*(lambda^60))
1860 =c
1870 :
1880 REM ** Mirrored object
1890 :
1900 DEF FNmirror(hitcol)
1910 PROCrefl(xnv,ynv,znv,cray_x,cray_y.cray_z)
1920 ry=refl_y:rx=refl_x:rz=refl_z
1930 =FNtrace(refl_x,refl_y,refl_z,xhit+xnv,yhit+ynv,zhit+znv,ind_refrac)
1940 :
1950 REM ** Opacity (refraction)
1960 :
1970 DEF FNopaque(Si,St)
1980 IF inside_sphere THEN angle=FNdot(cray_x,cray_y,cray_z,xnv,ynv,znv) ELSE angle=FNdot(-cray_x,-cray_y,-cray_z,xnv,ynv,znv)
1990 Nit=Si/St
2000 v=(1+((Nit*Nit)*((angle*angle)-1)))
2010 REM ** Total internal reflection = (v<0)
2020 IF v<0 THEN =0
2030 coeff=((Nit*angle)-SQRv)
2040 Tx=Nit*cray_x+coeff*xnv:Ty=Nit*cray_y+coeff*ynv:Tz=Nit*cray_z+coeff*znv
2050 PROCnormalise(Tx,Ty,Tz)
2060 =FNtrace(Rd_x,Rd_y,Rd_z,xhit+Rd_x,yhit+Rd_y,zhit+Rd_z,St)
2070 :
2080 REM ** Texture-mapping
2090 :
2100 DEF FNtmap(t,x,y,z)
2110 IF t=1 THEN =FNsmap(x,y,z)
2120 IF t=2 THEN =FNpmap(x,y,z)
2130 =0
2140 :
2150 REM ** Sphere texture mapping
2160 :
2170 DEF FNsmap(x,y,z)
2180 phi=ACS(FNdot(-x,-y,-z,0,1,0))
2190 v=phi/PI
2200 IF v=1 OR v=0 THEN u=0:GOTO 2250
2210 T=FNdot(Sex,Sey,Sez,x,y,z)/SINphi:IF T<-1 THEN T=-1 ELSE IF T>1 THEN T=1
2220 theta=ACS(T)/TPI
2230 PROCxprod(0,1,0,Sex,Sey,Sez)
2240 IF FNdot(xx,xy,xz,x,y,z)>0 THEN u=theta ELSE u=1-theta
2250 =FNgtext(u,v)
2260 :
2270 REM ** Polygon texture-mapping and bounds test
2280 :
2290 DEF FNpmap(x,y,z)
2300 Pax=P00x-P10x+P11x-P01x:Pay=P00y-P10y+P11y-P01y:Paz=P00z-P10z+P11z-P01z
2310 Pbx=P10x-P00x:Pby=P10y-P00y:Pbz=P10z-P00z
2320 Pcx=P01x-P00x:Pcy=P01y-P00y:Pcz=P01z-P00z
2330 Pdx=P00x:Pdy=P00y:Pdz=P00z
2340 PROCxprod(Pax,Pay,Paz,xnv,ynv,znv):Nax=xx:Nay=xy:Naz=xz
2350 PROCxprod(Pcx,Pcy,Pcz,xnv,ynv,znv):Ncx=xx:Ncy=xy:Ncz=xz
2360 Du0=FNdot(Ncx,Ncy,Ncz,Pdx,Pdy,Pdz)
2370 Du1=FNdot(Nax,Nay,Naz,Pdx,Pdy,Pdz)+FNdot(Ncx,Ncy,Ncz,Pbx,Pby,Pbz)
2380 Du2=FNdot(Nax,Nay,Naz,Pbx,Pby,Pbz)
2390 IF Du2=0 THEN GOTO 2430
2400 TDu2=2*Du2:Quxx=Nax/TDu2:Quxy=Nay/TDu2:Quxz=Naz/TDu2
2410 Dux=-Du1/TDu2:Duy=Du0/Du2:Quyx=-Ncx/Du2:Quyy=-Ncy/Du2:Quyz=-Ncz/Du2
2420 GOTO 2450
2430 u=(FNdot(Ncx,Ncy,Ncz,x,y,z)-Du0)/(Du1-FNdot(Nax,Nay,Naz,x,y,z))
2440 IF u>=0 AND u<=1 THEN GOTO 2490 ELSE =-1
2450 Ka=Dux+FNdot(Quxx,Quxy,Quxz,x,y,z):Kb=Duy+FNdot(Quyx,Quyy,Quyz,x,y,z)
2460 rt=Ka*Ka-Kb:IF rt<0 THEN =-1
2470 rt=SQRrt:u=Ka-rt:IF u>=0 AND u<=1 THEN GOTO 2490
2480 u=Ka+rt:IF u<0 OR u>1 THEN =-1
2490 PROCxprod(Pbx,Pby,Pbz,xnv,ynv,znv):Nbx=xx:Nby=xy:Nbz=xz
2500 Dv0=FNdot(Nbx,Nby,Nbz,Pdx,Pdy,Pdz)
2510 Dv1=FNdot(Nax,Nay,Naz,Pdx,Pdy,Pdz)+FNdot(Nbx,Nby,Nbz,Pcx,Pcy,Pcz)
2520 Dv2=FNdot(Nax,Nay,Naz,Pcx,Pcy,Pcz)
2530 IF Dv2=0 THEN GOTO 2570
2540 TDv2=2*Dv2:Qvxx=Nax/TDv2:Qvxy=Nay/TDv2:Qvxz=Naz/TDv2
2550 Dvx=-Dv1/TDv2:Dvy=Dv0/Dv2:Qvyx=-Nbx/Dv2:Qvyy=-Nby/Dv2:Qvyz=-Nbz/Dv2
2560 GOTO 2610
2570 l=(Dv1-FNdot(Nax,Nay,Naz,x,y,z))
2580 IF l=0 THEN =-1
2590 v=(FNdot(Nbx,Nby,Nbz,x,y,z)-Dv0)/l
2600 IF v>=0 AND v<=1 THEN GOTO 2650 ELSE =-1
2610 Ka=Dvx+FNdot(Qvxx,Qvxy,Qvxz,x,y,z):Kb=Dvy+FNdot(Qvyx,Qvyy,Qvyz,x,y,z)
2620 rt=Ka*Ka-Kb:IF rt<0 THEN =-1
2630 rt=SQRrt:v=Ka-rt:IF v>=0 AND v<=1 THEN GOTO 2650
2640 v=Ka+rt:IF v<0 OR v>1 THEN =-1
2650 =FNgtext(u,v)
2660 :
2670 REM ** Cross product
2680 :
2690 DEF PROCxprod(x1,y1,z1,x2,y2,z2)
2700 xx=(y1*z2-z1*y2):xy=(z1*x2-z2*x1):xz=(x1*y2-x2*y1)
2710 ENDPROC
2720 :
2730 REM ** Dot product
2740 :
2750 DEF FNdot(p1,q1,r1,p2,q2,r2)
2760 REM ** Vector signs calculated as <dest>-<source>
2770 =p1*p2+q1*q2+r1*r2
2780 :
2790 REM ** Calculate reflection vector
2800 :
2810 DEF PROCrefl(xn,yn,zn,cx,cy,cz)
2820 angle=FNdot(xn,yn,zn,cx,cy,cz)
2830 PROCnormalise(cx-2*angle*xn,cy-2*angle*yn,cz-2*angle*zn)
2840 refl_x=Rd_x:refl_y=Rd_y:refl_z=Rd_z
2850 ENDPROC
2860 :
2870 REM ** Normalise vector
2880 :
2890 DEF PROCnormalise(dv_x,dv_y,dv_z)
2900 dvm=SQR(dv_x*dv_x+dv_y*dv_y+dv_z*dv_z)
2910 Rd_x=dv_x/dvm:Rd_y=dv_y/dvm:Rd_z=dv_z/dvm
2920 ENDPROC
2930 :
2940 REM ** Insert here either the math function or sprite mapping
2950 REM ** 0 <= u <= 1  and  0 <= v <= 1  always
2960 :
2970 DEF FNgtext(u,v)
2980 U%=1279-u*1279:V%=1023-v*1023
2990 REM ** This example reads a sprite map
3000 REM SYS"OS_Byte",112,2
3010 REM p=POINT(U%-640,512-V%)
3020 REM SYS"OS_Byte",112,1
3030 REM ** Or instead use a maths function
3040 =(10*COSRADU%)+(5*SINRADU%)
3050 :
3060 REM ** Set mono palette
3070 :
3080 DEF PROCsetpalette
3090 FOR L%=1 TO 15
3100 COLOURL%,L%<<4,L%<<4,L%<<4
3110 NEXT
3120 ENDPROC
3130 :
3140 REM ** Scene data in form of:
3150 REM ** <OBJ_TYPE>,[<arg1>,<arg2>,...,<argn>],<colour>,<SURFACE>,[..args..]
3160 REM ** Where <OBJ_TYPE>=1 => SPHERE
3170 REM **       <OBJ_TYPE>=2 => PLANE
3180 REM **       <SURFACE>=1 => Matt
3190 REM **       <SURFACE>=2 => Shiny
3200 REM **       <SURFACE>=4 => Mirror
3210 REM **       <SURFACE>=8 => Opaque
3220 REM **       <SURFACE>=16 => Texture-Mapped
3230 REM **       <SURFACE>=32 => Quadliteral-mapped
3240 :
3250 REM ** Plane at y=-100, texture-mapped and mirrored
3260 :
3270 DATA 2,0,1,0,100,2,52
3280 :
3290 REM ** Plane vertices (because <SURFACE> AND 32 = 32)
3300 :
3310 DATA 4000,-100,1500,4000,-100,200,3000,-100,200,3000,-100,1500
3320 :
3330 REM ** Sphere at (3500,100,700), radius 200, texture-mapped with spec. ref
3340 :
3350 DATA 1,3500,100,700,200,1,18
3360 :
3370 REM ** No more
3380 DATA -1,0,0,0,0,0
```

Continued ▶

STRETCH

Listing 1

```
   10 REM >!RunImage
   20 REM Draw File Stretcher
   30 REM by Chris Ruseman
   40 REM for Archimedes only
   50 REM (c) BAU September 1990
   60 :
   70 DIM q% &500,buffer% &100,iconinf% &200,menubuf% &400,ic% &100,q2% &500
   80 PROCinitheap
   90 $q%="TASK"
  100 SYS "Wimp_Initialise",200,!q%,"Stretch" TO version%,mytask%
  110 PROCinitwindows
  120 PROCinitflags
  130 PROCmakemenus
  140 stretchicon%=FNiconbar
  150 ON ERROR PROCerrbox
  160 PROCinitdraw
  170 PROCsetextents
  180 REPEAT
  190 SYS "Wimp_Poll",0,q% TO reason%
  200 CASE reason% OF
  210 WHEN 0:PROCnull
  220 WHEN 1:PROCredraw(q%)
  230 WHEN 2:SYS "Wimp_OpenWindow",,q%
  240 WHEN 3:PROCclosewindow(!q%)
  250 WHEN 6:PROCcheckmouse(!q%,q%!4,q%!8,q%!12,q%!16,q%!20)
  260 WHEN 7:PROCdrag
  270 WHEN 8:PROCkey(!q%,q%!4,q%!8,q%!12,q%!16,q%!20,q%!24)
  280 WHEN 9:PROCmenuselect(q%)
  290 WHEN 17,18:PROCmessage
  300 ENDCASE
  310 UNTIL FALSE
  320 END
  330 :
  340 DEF PROCnull
  350 LOCAL newx%,newy%,b%
  360 IF corner%>0 THEN
  370 MOUSE newx%,newy%,b%
  380 IF newx%<>dragx% OR newy%<>dragy% THEN
  390 PROCalter(newx%,newy%,contup%)
  400 dragx%=newx%
  410 dragy%=newy%
  420 ENDIF
  430 IF (b% AND 5)=0 THEN
  440 PROCalter(newx%,newy%,TRUE)
  450 corner%=0
  460 PROCforceredraw(mainhand%)
  470 ENDIF
  480 ENDIF
  490 ENDPROC
  500 :
  510 DEF PROCdrag
  520 dragging%=FALSE
  530 SYS "Wimp_GetPointerInfo",,q%
  540 q%!32=q%!4
  550 q%!28=!q%
  560 q%!24=q%!16
  570 q%!20=q%!12
  580 q%!16=1
  590 q%!12=0
  600 q%!36=ext(curobj%)
  610 q%!40=&AFF
  620 $(q%+44)=FNlastbit(FNgetstr(savetext))+CHR$(0)
  630 !q%=60
  640 SYS "Wimp_SendMessage",17,q%,q%!20
  650 transptr%=0
  660 ENDPROC
  670 :
  680 DEF FNgetstr(a%)
  690 LOCAL b$
  700 WHILE ?a%>=32
  710 b$+=CHR$(?a%)
  720 a%+=1
  730 ENDWHILE
  740 =b$
  750 :
  760 DEF FNlastbit(s$)
  770 WHILE INSTR(s$,":")>0
  780 s$=MID$(s$,INSTR(s$,":")+1)
  790 ENDWHILE
  800 WHILE INSTR(s$,".")>0
  810 s$=MID$(s$,INSTR(s$,".")+1)
  820 ENDWHILE
  830 =s$
  840 :
  850 DEF PROCkey(hand%,icon%,xcar%,ycar%,carh%,carpos%,key%)
  860 CASE hand% OF
  870 WHEN savehand%:
  880 IF key%=13 PROCsave(FNgetstr(savetext)):PROCclosemenu
  890 WHEN zoomhand%:
  900 IF key%=13 THEN
  910 PROCtextend(zoomhand%,(icon%+1) MOD 2)
  920 IF icon%=1 THEN
  930 zoom1%=VAL($(FNtextaddr(zoomhand%,0)))
  940 zoom2%=VAL($(FNtextaddr(zoomhand%,1)))
  950 PROCchangezoom
  960 ENDIF
  970 ENDIF
  980 ENDCASE
  990 ENDPROC
 1000 :
 1010 DEF FNtextaddr(hand%,icon%)
 1020 PROCgeticoninfo(hand%,icon%)
 1030 =iconinf%!28
 1040 :
 1050 DEF PROCgeticoninfo(hand%,icon%)
 1060 !iconinf%=hand%
 1070 iconinf%!4=icon%
 1080 SYS "Wimp_GetIconState",,iconinf%
 1090 ENDPROC
 1100 :
 1110 DEF PROCredraw(q%)
 1120 LOCAL object%
 1130 SYS "Wimp_RedrawWindow",,q% TO more%
 1140 WHILE more%
 1150 PROCextract(q%)
 1160 IF !q%=mainhand% THEN
 1170 IF loaded%>0 THEN
 1180 FOR object%=0 TO maxf%-1
 1190 IF block(object%)>-1 PROCdraw(block2(object%),ax0%+offx%(object%)*zoom1%/zoom2%,ay0%+(offy%(object%)-pagesize%)*zoom1%/zoom2%,object%,corner%)
 1200 NEXT
 1210 ENDIF
 1220 ENDIF
 1230 SYS "Wimp_GetRectangle",,q% TO more%
 1240 ENDWHILE
 1250 ENDPROC
 1260 :
 1270 DEF PROCmessage
 1280 LOCAL task%,ref%
 1290 task%=q%!4
 1300 ref%=q%!8
 1310 CASE q%!16 OF
 1320 WHEN 0:PROCshutdownwimp
 1330 WHEN 1:
 1340 IF task%=mytask% THEN
 1350 PROCtellthemoff("You can't do that!")
 1360 ELSE
 1370 tempbufsize%=q%!36
 1380 IF tempbufsize%=-1 tempbufsize%=1024
 1390 PROCfreeablock(tempbuf%)
 1400 tempbuf%=FNgetablock(tempbufsize%)
 1410 transptr%=0
 1420 q%!20=tempbuf%
 1430 q%!24=tempbufsize%
 1440 PROCreply(18,6)
 1450 ENDIF
 1460 WHEN 2:
 1470 PROCsave(FNgetstr(q%+44))
 1480 SYS "Wimp_GetPointerInfo",,q%
 1490 q%!20=q%!12
 1500 q%!24=q%!16
 1510 q%!28=!q%
 1520 q%!32=q%!4
 1530 !q%=44
 1540 q%!40=&AFF
 1550 PROCreply(17,3)
 1560 waitingforack%=TRUE
 1570 PROCclosemenu
 1580 WHEN 3:
 1590 IF q%!12=0 THEN
 1600 PROCload(FNgetstr(q%+44),ok%)
 1610 IF ok% THEN
 1620 !q%=20
 1630 PROCreply(17,4)
 1640 ENDIF
 1650 ENDIF
 1660 WHEN 4:waitingforack%=FALSE
 1670 WHEN 6:
 1680 IF transptr%=ext(curobj%) saving%=FALSE
 1690 bytestogo%=ext(curobj%)-transptr%
 1700 IF bytestogo%>q%!24 bytestogo%=q%!24
 1710 SYS "Wimp_TransferBlock",mytask%,block2(curobj%)+transptr%,task%,q%!20,bytestogo%
 1720 q%!24=bytestogo%
 1730 PROCreply(18,7)
 1740 transptr%+=bytestogo%
 1750 WHEN 7:
 1760 transptr%+=q%!24
 1770 IF transptr%<tempbufsize% THEN
 1780 PROCmainload("Selection",transptr%)
 1790 ELSE
 1800 tempbuf%=FNextendablock(tempbuf%,1024)
 1810 tempbufsize%+=1024
 1820 q%!20=tempbuf%+transptr%
 1830 q%!24=tempbufsize%-transptr%
 1840 PROCreply(18,6)
 1850 ENDIF
 1860 ENDCASE
 1870 ENDPROC
 1880 :
 1890 DEF PROCreply(messtype%,reason%)
 1900 q%!12=ref%
 1910 q%!16=reason%
 1920 SYS "Wimp_SendMessage",messtype%,q%,task%
 1930 ENDPROC
 1940 :
 1950 DEF PROCcheckmouse(mousex%,mousey%,b%,handle%,icon%,ob%)
 1960 IF (b% AND %0101)>0 THEN
 1970 CASE handle% OF
 1980 WHEN -2:IF active% PROCfront ELSE PROCreopen
 1990 WHEN mainhand%:
 2000 IF corner%=0 THEN
 2010 PROCbegineditcorner(mousex%,mousey%,b%)
 2020 ELSE
 2030 PROCalter(mousex%,mousey%,TRUE)
 2040 corner%=0
 2050 PROCforceredraw(mainhand%)
 2060 ENDIF
 2070 WHEN savehand%:
 2080 CASE icon% OF
 2090 WHEN 0:
 2100 PROCsave(FNgetstr(savetext))
 2110 PROCclosemenu
 2120 WHEN 3:PROCinitsavedrag(savehand%)
 2130 ENDCASE
 2140 WHEN zoomhand%:
 2150 IF (b% AND 4)=0 cz%=-1 ELSE cz%=1
 2160 CASE icon% OF
 2170 WHEN 2:zoom1%+=cz%
 2180 WHEN 3:zoom1%-=cz%
 2190 WHEN 4:zoom2%+=cz%
 2200 WHEN 5:zoom2%-=cz%
 2210 ENDCASE
 2220 PROCchangezoom
 2230 ENDCASE
 2240 ENDIF
 2250 IF (b% AND 2)>0 THEN
 2260 CASE handle% OF
 2270 WHEN -2:
 2280 menuhandle%=101
 2290 PROCopenmenu(quitmenu%,mousex%-86,176)
 2300 WHEN mainhand%:
 2310 menuhandle%=102
 2320 PROCpreparemenus
 2330 PROCopenmenu(mainmenu%,mousex%-86,mousey%)
 2340 ENDCASE
 2350 ENDIF
 2360 ENDPROC
 2370 :
 2380 DEF PROCmakemenus
 2390 menuptr%=menubuf%
 2400 selectmenu%=FNmakemen("|winsvSave,Delete","Selection")
 2410 mainmenu%=FNmakemen("|winidInfo,"+FNsub("Selection",selectmenu%)+",|winzmZoom,Update","Stretch")
 2420 quitmenu%=FNmakemen("|winidInfo,Quit","Stretch")
 2430 ENDPROC
 2440 :
 2450 DEF PROCpreparemenus
 2460 PROCtick(mainmenu%,3,contup%)
 2470 PROClight(mainmenu%,1,curobj%>-1)
 2480 IF curobj%>-1 THEN $savetext=f$(curobj%)
 2490 ENDPROC
 2500 :
 2510 DEF PROClight(a%,i%,c%)
 2520 a%=a%+36+24*i%
 2530 IF c% THEN !a%=!a% AND &FFBFFFFF ELSE !a%=!a% OR &00400000
 2540 ENDPROC
 2550 :
 2560 DEF PROCtick(a%,i%,c%)
 2570 a%=a%+28+24*i%
 2580 IF c% THEN !a%=!a% OR 1 ELSE !a%=!a% AND &FFFFFFFE
 2590 ENDPROC
 2600 :
 2610 DEF FNsub(m$,m%)="|sub"+RIGHT$("0000000"+STR$(m%),12)+m$
 2620 :
 2630 DEF PROCmenuitem(text$)
 2640 LOCAL menuflags%,iconflags%,submenu%,indlen%,valid%
 2650 valid%=-1
 2660 ii%=FALSE
 2670 indlen%=-1
 2680 submenu%=-1
 2690 IF text$="" ENDPROC
 2700 menuflags%=0
 2710 iconflags%=&07000021
 2720 WHILE LEFT$(text$,1)="|"
 2730 CASE MID$(text$,2,3) OF
 2740 WHEN "sub":
 2750 submenu%=VAL(MID$(text$,5,12))
 2760 text$=MID$(text$,17)
 2770 WHEN "win":
 2780 CASE MID$(text$,5,2) OF
 2790 WHEN "sv":submenu%=savehand%
 2800 WHEN "zm":submenu%=zoomhand%
 2810 WHEN "id":submenu%=infohand%
 2820 ENDCASE
 2830 text$=MID$(text$,7)
 2840 ENDCASE
 2850 ENDWHILE
 2860 IF LEN(text$)>menumax% menumax%=LEN(text$)
 2870 menuptr%!0=menuflags%
 2880 menuptr%!4=submenu%
 2890 menuptr%!8=iconflags%
 2900 IF LEN(text$)>11 indlen%=LEN(text$)
 2910 IF indlen%<0 THEN
 2920 $(menuptr%+12)=text$
 2930 ELSE
 2940 menend%-=(indlen%+1)
 2950 menuptr%!8=(menuptr%!8) OR %100000000
 2960 menuptr%!12=menend%
 2970 menuptr%!16=valid%
 2980 menuptr%!20=indlen%
 2990 $menend%=text$
 3000 ENDIF
 3010 menuptr%+=24
 3020 ENDPROC
 3030 :
 3040 DEF FNpar(sep$)
 3050 i1%=i%+1:i%=INSTR(menu$+sep$,sep$,i1%)
 3060 =MID$(menu$,i1%,i%-i1%)
 3070 :
 3080 DEF FNmakemen(menu$,menutitle$)
 3090 LOCAL menumax%,wasptr%
 3100 wasptr%=menuptr%
 3110 menumax%=10
 3120 i%=0
 3130 menuptr%!20=40
 3140 $menuptr%=menutitle$
 3150 menuptr%?12=7
 3160 menuptr%?13=2
 3170 menuptr%?14=7
 3180 menuptr%?15=0
 3190 maxaddr%=menuptr%+16
 3200 menuptr%!24=0
 3210 menuptr%+=28
 3220 REPEAT
 3230 item$=FNpar(",")
 3240 PROCmenuitem(item$)
 3250 UNTIL item$=""
 3260 menuptr%!-24=(menuptr%!-24) OR &80
 3270 !maxaddr%=menumax%*16+32
 3280 =wasptr%
 3290 :
 3300 DEF PROCopenmenu(m%,x%,y%)
 3310 menux%=x%
 3320 menuy%=y%
 3330 SYS "Wimp_CreateMenu",,m%,x%,y%
 3340 ENDPROC
 3350 :
 3360 DEF PROCinitsavedrag(savehand%)
 3370 LOCAL x%,y%,ysize%
 3380 !q%=savehand%
 3390 SYS "Wimp_GetWindowState",,q%
 3400 ysize%=q%!16-q%!8
 3410 x%=q%!4
 3420 y%=q%!8
 3430 q%!4=3
 3440 SYS "Wimp_GetIconState",,q%
 3450 q%!8+=x%
 3460 q%!12+=y%+ysize%
 3470 q%!16+=x%
 3480 q%!20+=y%+ysize%
 3490 q%!24=0
 3500 q%!28=0
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3510 q%!32=1279
3520 q%!36=1023
3530 !q%=0
3540 q%!4=5
3550 dragging%=TRUE
3560 SYS "Wimp_DragBox",,q%
3570 ENDPROC
3580 :
3590 DEF FNiconbar
3600 LOCAL ii%
3610 !ic%=-1:ic%!4=0:ic%!8=0:ic%!12=64:
ic%!16=68
3620 ic%!20=&7000311A
3630 DIM ic%!24 12
3640 $(ic%!24)="!Stretch"
3650 ic%!28=1
3660 ic%!32=12
3670 SYS "Wimp_CreateIcon",,ic% TO ii%
3680 =ii%
3690 :
3700 DEF PROCmenuselect(menus%)
3710 CASE menuhandle% OF
3720 WHEN 101:IF !menus%=1 PROCshutdown
wimp
3730 WHEN 102:PROCdecodemainmenu
3740 ENDCASE
3750 ENDPROC
3760 :
3770 DEF PROCdecodemainmenu
3780 LOCAL redo%
3790 SYS "Wimp_GetPointerInfo",,q2%
3800 redo%=(((q2%!8) AND 1)>0)
3810 CASE !menus% OF
3820 WHEN 1:
3830 IF menus%!4=1 THEN
3840 PROCfreeablock(block(curobj%))
3850 PROCfreeablock(block2(curobj%))
3860 PROCfreeablock(points(curobj%))
3870 loaded%-=1
3880 curobj%=-1
3890 PROCforceredraw(mainhand%)
3900 ENDIF
3910 WHEN 3:contup%=NOT contup%
3920 ENDCASE
3930 IF redo% PROCpreparemenus:PROCopen
menu(mainmenu%,menux%,menuy%)
3940 ENDPROC
3950 :
3960 DEF PROCshutdownwimp
3970 $q%="TASK"
3980 SYS "Wimp_CloseDown",mytask%,!q%
3990 END
4000 ENDPROC
4010 :
4020 DEF PROCfront
4030 !q%=mainhand%
4040 SYS "Wimp_GetWindowState",,q%
4050 q%!28=-1
4060 SYS "Wimp_OpenWindow",,q%
4070 ENDPROC
4080 :
4090 DEF PROCreopen
4100 !q%=mainhand%:q%!28=-1
4110 q%!4=200:q%!8=300
4120 q%!12=700:q%!16=800
4130 q%!20=0:q%!24=0
4140 SYS "Wimp_OpenWindow",,q%
4150 active%=TRUE
4160 ENDPROC
4170 :
4180 DEF FNcreatewindow(name$)
4190 LOCAL hand%
4200 SYS "Wimp_LoadTemplate",,templates
%,ind%,indir%+&1FFF,-1,name$,0 TO ,,ind%
4210 templates%!68=10+(10<<16)
4220 SYS "Wimp_CreateWindow",,templates
% TO hand%
4230 =hand%
4240 :
4250 DEF PROCclosewindow(hand%)
4260 !q%=hand%
4270 SYS "Wimp_CloseWindow",,q%
4280 IF hand%=mainhand% active%=FALSE
4290 ENDPROC
4300 :
4310 DEF PROCextract(q%)
4320 ax0%=q%!4-q%!20
4330 ay0%=q%!16-q%!24
4340 ENDPROC
4350 :
4360 DEF PROCforceredraw(hand%)
4370 !q2%=hand%
4380 SYS "Wimp_GetWindowInfo",,q2%
4390 SYS "Wimp_ForceRedraw",hand%,q2%!4
4,q2%!48,q2%!52,q2%!56
4400 ENDPROC
4410 :
4420 DEF PROCsave(f$)
4430 PROCbounds(block2(curobj%),ext(cur
obj%))
4440 SYS "OS_File",10,f$,&AFF,,block2(c
urobj%),block2(curobj%)+ext(curobj%)
4450 ENDPROC
4460 :
4470 DEF PROCload(f$,RETURN ok%)
4480 LOCAL type%,ftype%,in%,s%,l%,ext
4490 ok%=FALSE
4500 IF f$<>"" THEN
4510 SYS "OS_File",5,f$ TO type%,,ftype
%,,ext
4520 IF type%=1 AND (ftype% AND &FFFFFF
00)=dft THEN
4530 IF loaded%<maxf% PROCmainload(f$,e
xt) ELSE PROCtellthemoff("You may only l
oad "+STR$(maxf%)+" Draw files")
4540 ENDIF
4550 ENDIF
4560 IF ok% AND (NOT active%) PROCsetex
tents:PROCreopen
4570 ENDPROC
4580 :
4590 DEF PROCmainload(f$,ext)
4600 LOCAL i%,n%,mx%,my%,mb%
4610 MOUSE mx%,my%,mb%
4620 SYS "Hourglass_On"
4630 n%=0
4640 WHILE block(n%)>-1
4650 n%+=1
4660 ENDWHILE
4670 block(n%)=FNgetablock(ext)
4680 block2(n%)=FNgetablock(ext)
4690 points(n%)=FNgetablock(ext)
4700 IF f$="Selection" THEN
4710 FOR i%=0 TO ext-1
4720 i%?block(n%)=i%?tempbuf%
4730 i%?block2(n%)=i%?tempbuf%
4740 NEXT
4750 PROCfreeablock(tempbuf%)
4760 ELSE
4770 SYS "OS_File",255,f$,block(n%)
4780 SYS "OS_File",255,f$,block2(n%)
4790 ENDIF
4800 !points(n%)=0
4810 x(n%,1)=block(n%)!24
4820 y(n%,1)=block(n%)!28
4830 x(n%,2)=block(n%)!32
4840 y(n%,2)=block(n%)!28
4850 x(n%,3)=block(n%)!32
4860 y(n%,3)=block(n%)!36
4870 x(n%,4)=block(n%)!24
4880 y(n%,4)=block(n%)!36
4890 !q2%=mainhand%
4900 SYS "Wimp_GetWindowState",,q2%
4910 PROCextract(q2%)
4920 offx%(n%)=(mx%-ax0%)*zoom2%/zoom1%
4930 offy%(n%)=(my%-ay0%)*zoom2%/zoom1%
+pagesize%
4940 ext(n%)=ext
4950 f$(n%)=f$
4960 loaded%+=1
4970 ok%=TRUE
4980 SYS "Hourglass_Off"
4990 PROCforceredraw(mainhand%)
5000 ENDPROC
5010 :
5020 DEF PROCtellthemoff(t$)
5030 !buffer%=0
5040 $(buffer%+4)=t$+CHR$(0)
5050 SYS "Wimp_ReportError",buffer%,1,"
Stretch"
5060 ENDPROC
5070 :
5080 DEF PROCerrbox
5090 LOCAL what%
5100 SYS "Wimp_DragBox",,-1
5110 !buffer%=ERR
5120 $(buffer%+4)=REPORT$+" / "+STR$ERL
+CHR$0
5130 SYS "Wimp_ReportError",buffer%,3,"
Stretch" TO ,what%
5140 IF what%=2 PROCshutdownwimp
5150 ENDPROC
5160 :
5170 DEF PROCinitwindows
5180 DIM templates% &800,indir% &800
5190 ind%=indir%
5200 SYS "Wimp_OpenTemplate",,"<Stretch
$Dir>.Templates"
5210 mainhand%=FNcreatewindow("Main")
5220 savehand%=FNcreatewindow("Save")
5230 zoomhand%=FNcreatewindow("Magnifie
r")
5240 infohand%=FNcreatewindow("Info")
5250 SYS "Wimp_CloseTemplate"
5260 savetext=FNtextaddr(savehand%,2)
5270 $FNtextaddr(infohand%,4)="0.50 (1s
t July 1990)"
5280 ENDPROC
5290 :
5300 DEF PROCinitflags
5310 dragging%=FALSE
5320 waitingforack%=FALSE
5330 corner%=0
5340 dragtype%=0
5350 contup%=FALSE
5360 loaded%=0
5370 curobj%=-1
5380 zoom1%=1:zoom2%=1
5390 active%=FALSE
5400 tempbuf%=-1
5410 PROCsetzoom
5420 ENDPROC
5430 :
5440 DEF PROCchangezoom
5450 IF zoom1%<1 zoom1%=1
5460 IF zoom1%>8 zoom1%=8
5470 IF zoom2%<1 zoom2%=1
5480 IF zoom2%>8 zoom2%=8
5490 PROCsetzoom
5500 PROCredrawicon(zoomhand%,0)
5510 PROCredrawicon(zoomhand%,1)
5520 PROCsetextents
5530 PROCforceredraw(mainhand%)
5540 ENDPROC
5550 :
5560 DEF PROCtextend(hand%,icon%)
5570 LOCAL i%
5580 PROCgeticoninfo(hand%,icon%)
5590 WHILE i%?(iconinf%!28)>=32
5600 i%+=1
5610 ENDWHILE
5620 SYS "Wimp_SetCaretPosition",hand%,
icon%,,,-1,i%
5630 ENDPROC
5640 :
5650 DEF PROCredrawicon(hand%,icon%)
5660 LOCAL more%
5670 PROCgeticoninfo(hand%,icon%)
5680 !q2%=hand%
5690 q2%!4=iconinf%!8
5700 q2%!8=iconinf%!12
5710 q2%!12=iconinf%!16
5720 q2%!16=iconinf%!20
5730 SYS "Wimp_UpdateWindow",,q2% TO mo
re%
5740 WHILE more%
5750 SYS "Wimp_GetRectangle",,q2% TO mo
re%
5760 ENDWHILE
5770 ENDPROC
5780 :
5790 DEF PROCsetzoom
5800 PROCseticonval(zoomhand%,0,zoom1%)
5810 PROCseticonval(zoomhand%,1,zoom2%)
5820 ENDPROC
5830 :
5840 DEF PROCseticonval(hand%,icon%,val
%)
5850 LOCAL v$
5860 v$=STR$(val%)
5870 $FNtextaddr(hand%,icon%)=v$
5880 ?(FNtextaddr(hand%,icon%)+LEN(v$))
=0
5890 ENDPROC
5900 :
5910 DEF PROCclosemenu
5920 SYS "Wimp_CreateMenu",,-1
5930 ENDPROC
5940 :
5950 DEF PROCsetextents
5960 LOCAL smaller%,size%
5970 size%=zoom1%/zoom2%*pagesize%
5980 !q2%=mainhand%
5990 SYS "Wimp_GetWindowState",,q2%
6000 smaller%=size%<(q2%!12-q2%!4)
6010 !q%=0
6020 q%!4=-size%
6030 q%!8=size%
6040 q%!12=0
6050 SYS "Wimp_SetExtent",mainhand%,q%
6060 IF smaller% THEN
6070 q2%!12=q2%!4+size%
6080 q2%!8=q2%!16-size%
6090 q2%!20=0
6100 q2%!24=0
6110 SYS "Wimp_OpenWindow",,q2%
6120 ELSE
6130 IF q2%!24-(q2%!16-q2%!8)<-size% AN
D active% THEN
6140 q2%!24=-size%+(q2%!16-q2%!8)
6150 SYS "Wimp_OpenWindow",,q2%
6160 ENDIF
6170 ENDIF
6180 ENDPROC
6190 :
6200 DEF PROCinitheap
6210 heapd%=HIMEM
6220 heapsize%=32*1024
6230 SYS "Wimp_SlotSize",-1,-1 TO appsi
ze%
6240 SYS "Wimp_SlotSize",appsize%+heaps
ize%,-1
6250 SYS "OS_Heap",0,heapd%,,heapsize%
6260 ENDPROC
6270 :
6280 DEF FNgetablock(size%)
6290 LOCAL loc%,ok%,heapfull%,largest%
6300 heapfull%=FALSE
6310 REPEAT
6320 SYS "OS_Heap",1,heapd% TO ,,larges
t%
6330 IF largest%>=size% THEN
6340 SYS "OS_Heap",2,heapd%,,size% TO ,
,loc%
6350 ok%=TRUE
6360 ELSE
6370 heafull%=FNtrytoextendheap
6380 ENDIF
6390 UNTIL ok% OR heapfull%
6400 IF heapfull% THEN ERROR 17,"Stretc
h has run out of memory"
6410 =loc%
6420 :
6430 DEF FNextendablock(loc%,size%)
6440 LOCAL ok%,heapfull%,newloc%
6450 IF loc%<=0 THEN=FNgetablock(size%)
6460 heapfull%=FALSE
6470 REPEAT
6480 SYS "XOS_Heap",4,heapd%,loc%,size%
 TO ,,newloc%;ok%
6490 ok%=((ok% AND 1)=0)
6500 IF NOT ok% THEN heapfull%=FNtrytoe
xtendheap
6510 UNTIL ok% OR heapfull%
6520 IF heapfull% THEN ERROR 17,"Stretc
h has run out of memory"
6530 =newloc%
6540 :
6550 DEF FNtrytoextendheap
6560 LOCAL heapfull%,new%
6570 SYS "XWimp_SlotSize",appsize%+heap
size%+32*1024,-1 TO new%;heapfull%
6580 heapfull%=((heapfull% AND 1)=1)
6590 IF new%=appsize%+heapsize% THEN he
apfull%=TRUE
6600 IF NOT heapfull% THEN
6610 heapsize%+=32*1024
6620 SYS "OS_Heap",5,heapd%,,32*1024
6630 ENDIF
6640 =heapfull%
6650 :
6660 DEF PROCfreeablock(RETURN loc%)
6670 IF loc%>0 THEN SYS "OS_Heap",3,hea
pd%,loc%
6680 loc%=-1
6690 ENDPROC
6700 :
6710 DEF PROCalter(mousex%,mousey%,doit
%)
6720 LOCAL i%,x,y
6730 IF dragtype%=0 THEN
6740 !q2%=mainhand%
6750 SYS "Wimp_GetWindowState",,q2%
6760 PROCextract(q2%)
6770 x=mousex%-ax0%-(offx%(curobj%))*zo
om1%/zoom2%
6780 y=mousey%-ay0%-(offy%(curobj%)-pag
esize%)*zoom1%/zoom2%
6790 paths=0
6800 ptr=0
6810 base=block(curobj%)
6820 PROCfileheader
6830 x(curobj%,corner%)=&100*x/scale+xl
o
6840 y(curobj%,corner%)=&100*y/scale+yl
o
6850 IF doit% PROCdistort(block(curobj%
),block2(curobj%),curobj%)
6860 ELSE
6870 offx%(curobj%)+=(mousex%-dragx%)*z
oom2%/zoom1%
6880 offy%(curobj%)+=(mousey%-dragy%)*z
oom2%/zoom1%
6890 ENDIF
6900 PROCforceredraw(mainhand%)
6910 ENDPROC
6920 :
6930 DEF PROCbegineditcorner(mousex%,mo
usey%,b%)
6940 LOCAL i%,j%,x,y,xpos,ypos,oldcurob
j%,minx,miny,maxx,maxy
6950 !q2%=mainhand%
6960 SYS "Wimp_GetWindowState",,q2%
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 6970 PROCextract(q2%)
 6980 corner%=0
 6990 oldcurobj%=curobj%
 7000 curobj%=-1
 7010 IF loaded%>0 THEN
 7020 FOR j%=0 TO maxf%-1
 7030 IF block(j%)>-1 THEN
 7040 xpos=0
 7050 ypos=0
 7060 x=mousex%-ax0%-(offx%(j%))*zoom1%/
zoom2%
 7070 y=mousey%-ay0%+(pagesize%-offy%(j%
))*zoom1%/zoom2%
 7080 ptr=0
 7090 base=block(j%)
 7100 PROCfileheader
 7110 minx=FNxs(j%,1)
 7120 maxx=minx
 7130 miny=FNys(j%,1)
 7140 maxy=miny
 7150 FOR i%=2 TO 4
 7160 IF FNxs(j%,i%)<minx minx=FNxs(j%,i
%)
 7170 IF FNxs(j%,i%)>maxx maxx=FNxs(j%,i
%)
 7180 IF FNys(j%,i%)<miny miny=FNys(j%,i
%)
 7190 IF FNys(j%,i%)>maxy maxy=FNys(j%,i
%)
 7200 NEXT
 7210 IF x>=minx-16 AND x<=maxx+16 AND y
>=miny-16 AND y<=maxy+16 THEN
 7220 curobj%=j%
 7230 FOR i%=1 TO 4
 7240 IF ABS(x-FNxs(j%,i%))<16 AND ABS(y
-FNys(j%,i%))<16 THEN
 7250 curobj%=j%
 7260 corner%=i%
 7270 dragx%=mousex%
 7280 dragy%=mousey%
 7290 IF (b% AND 4)=0 dragtype%=1 ELSE d
ragtype%=0
 7300 PROCforceredraw(mainhand%)
 7310 ENDIF
 7320 NEXT
 7330 ENDIF
 7340 ENDIF
 7350 NEXT
 7360 ENDIF
 7370 IF oldcurobj%<>curobj% PROCforcere
draw(mainhand%)
 7380 ENDPROC
 7390 :
 7400 DEF PROCinitdraw
 7410 maxf%=8
 7420 pagesize%=&1000
 7430 DIM offx%(maxf%),offy%(maxf%),ext(
maxf%)
 7440 DIM block(maxf%),block2(maxf%),poi
nts(maxf%),f$(maxf%)
 7450 DIM x(maxf%,4),y(maxf%,4)
 7460 block()=-1
 7470 block2()=-1
 7480 points()=-1
 7490 DIM mat 6*4,caps 4*4
 7500 xsize=800:ysize=600
 7510 corner=0
 7520 dft=&FFFAFF00
 7530 ENDPROC
 7540 :
 7550 DEF PROCdraw(base,xpos,ypos,object
%,corner%)
 7560 LOCAL i%
 7570 paths=0
 7580 ptr=0
 7590 PROCfileheader
 7600 IF corner%=0 OR contup% THEN
 7610 REPEAT
 7620 PROCobject
 7630 UNTIL ptr=ext(object%)
 7640 ENDIF
 7650 IF object%=curobj% OR corner%>0 TH
EN
 7660 SYS "Wimp_SetColour",11
 7670 MOVE FNxs(object%,1),FNys(object%,
1)
 7680 DRAW FNxs(object%,2),FNys(object%,
2)
 7690 DRAW FNxs(object%,3),FNys(object%,
3)
 7700 DRAW FNxs(object%,4),FNys(object%,
4)
 7710 DRAW FNxs(object%,1),FNys(object%,
1)
 7720 ENDIF
 7730 IF object%=curobj% THEN
 7740 FOR i%=1 TO 4
 7750 RECTANGLE FNxs(curobj%,i%)-12,FNys
(curobj%,i%)-12,32,32
 7760 NEXT
 7770 ENDIF
 7780 ENDPROC
 7790 :
 7800 DEF FNxs(o,n)
 7810 =((x(o,n)-xlo)/&100*scale+xpos)
 7820 :
 7830 DEF FNys(o,n)
 7840 =((y(o,n)-ylo)/&100*scale+ypos)
 7850 :
 7860 DEF PROCfileheader
 7870 Draw$=FNstring(4)
 7880 major=FNword
 7890 minor=FNword
 7900 id$=FNstring(12)
 7910 PROCgetbox(xlo,ylo,xhi,yhi)
 7920 mscale=&10000*zoom1%/zoom2%
 7930 scale=mscale/&10000
 7940 mat!0=mscale:mat!4=0
 7950 mat!8=0:mat!12=mscale
 7960 mat!16=xpos*&100-xlo*scale
 7970 mat!20=ypos*&100-ylo*scale
 7980 ENDPROC
 7990 :
 8000 DEF PROCobject
 8010 LOCAL type,size,xlo,ylo,xhi,yhi
 8020 type=FNword
 8030 size=FNword
 8040 IF type<>0 AND type<>7 PROCgetbox(
xlo,ylo,xhi,yhi)
 8050 CASE type OF
 8060 WHEN 0,1,5,9,10:PROCskipobj
 8070 WHEN 2:PROCpath
 8080 WHEN 6:PROCgroup
 8090 WHEN 7:PROCtagged
 8100 OTHERWISE:ERROR 0,"Unknown Draw ob
ject"
 8110 ENDCASE
 8120 ENDPROC
 8130 :
 8140 DEF PROCskipobj
 8150 IF type=0 ptr+=(size-2*4) ELSE ptr
+=(size-6*4)
 8160 ENDPROC
 8170 :
 8180 DEF PROCpath
 8190 pathend=ptr-6*4+size
 8200 fillcol=FNword
 8210 linecol=FNword
 8220 linewidth=FNword
 8230 linestyle=FNword
 8240 dash=FNdashpat
 8250 caps?0=(linestyle AND %000011)
 8260 caps?1=(linestyle AND %001100)>>2
 8270 caps?2=(linestyle AND %110000)>>4
 8280 caps?3=0
 8290 caps!4=10*&10000
 8300 tricapw=(linestyle>>16) AND &FF
 8310 tricapl=(linestyle>>24) AND &FF
 8320 tricap=((tricapl/16*&100)<<16)+(tr
icapw/16*&100)
 8330 caps!8=tricap
 8340 caps!12=tricap
 8350 IF linestyle AND 64 THEN style=2 E
LSE style=0
 8360 points(object%)!(paths+0)=ptr
 8370 points(object%)!(paths+4)=0
 8380 paths+=4
 8390 IF fillcol<>-1 THEN
 8400 SYS "ColourTrans_SetGCOL",fillcol
 8410 SYS "Draw_Fill",base+ptr,style OR
%110000,mat,0
 8420 ENDIF
 8430 IF linecol<>-1 THEN
 8440 SYS "ColourTrans_SetGCOL",linecol
 8450 IF linewidth=0 THEN lstyle=style O
R %011000 ELSE lstyle=style OR %111000
 8460 SYS "Draw_Stroke",base+ptr,lstyle,
mat,0,linewidth,caps,dash
 8470 ENDIF
 8480 ptr=pathend
 8490 ENDPROC
 8500 :
 8510 DEF FNdashpat
 8520 IF linestyle AND 128 THEN
 8530 dash=base+ptr
 8540 dashoff=FNword
 8550 dashnum=FNword
 8560 ptr+=dashnum*4
 8570 ELSE
 8580 dash=0
 8590 ENDIF
 8600 =dash
 8610 :
 8620 DEF PROCgroup
 8630 LOCAL end
 8640 name$=FNstring(12)
 8650 end=ptr-12-6*4+size
 8660 REPEAT
 8670 PROCobject
 8680 UNTIL ptr=end
 8690 ENDPROC
 8700 :
 8710 DEF PROCtagged
 8720 ident=FNword
 8730 PROCobject
 8740 ENDPROC
 8750 :
 8760 DEF FNstring(letters)
 8770 w$=""
 8780 FOR i=1 TO letters
 8790 w$+=FNchar
 8800 NEXT
 8810 =w$
 8820 :
 8830 DEF PROCgetbox(RETURN xl,RETURN yl
,RETURN xh,RETURN yh)
 8840 xl=FNword:yl=FNword
 8850 xh=FNword:yh=FNword
 8860 ENDPROC
 8870 :
 8880 DEF FNchar
 8890 =CHR$FNbyte
 8900 :
 8910 DEF FNbyte
 8920 byte=base?ptr
 8930 ptr+=1
 8940 =byte
 8950 :
 8960 DEF FNword
 8970 word=base!ptr
 8980 ptr+=4
 8990 =word
 9000 :
 9010 DEF PROCdistort(read,write,object%
)
 9020 SYS "Hourglass_On"
 9030 addr=0
 9040 REPEAT
 9050 path=points(object%)!addr
 9060 IF path<>0 THEN
 9070 REPEAT
 9080 element=read!path
 9090 path+=4
 9100 CASE element OF
 9110 WHEN 2,3,7,8:PROCadjust(object%,1)
 9120 WHEN 6:PROCadjust(object%,3)
 9130 ENDCASE
 9140 UNTIL element=0
 9150 ENDIF
 9160 addr+=4
 9170 UNTIL path=0
 9180 SYS "Hourglass_Off"
 9190 ENDPROC
 9200 :
 9210 DEF PROCadjust(o,n)
 9220 FOR i=1 TO n
 9230 x=!(read+path+0)
 9240 y=!(read+path+4)
 9250 px=(x-xlo)/(xhi-xlo)
 9260 py=(y-ylo)/(yhi-ylo)
 9270 xx=x(o,1)+px*(x(o,2)-x(o,1))+py*(x
(o,4)-x(o,1)+px*(x(o,3)-x(o,4)-x(o,2)+x(
o,1)))
 9280 yy=y(o,1)+px*(y(o,2)-y(o,1))+py*(y
(o,4)-y(o,1)+px*(y(o,3)-y(o,4)-y(o,2)+y(
o,1)))
 9290 !(write+path+0)=xx
 9300 !(write+path+4)=yy
 9310 path+=8
 9320 NEXT
 9330 ENDPROC
 9340 :
 9350 DEF PROCbounds(base,ext)
 9360 bound_xlo=1E38:bound_xhi=-1E38
 9370 bound_ylo=1E38:bound_yhi=-1E38
 9380 ptr=40
 9390 REPEAT
 9400 PROCobjectbound
 9410 UNTIL ptr=ext
 9420 base!24=bound_xlo
 9430 base!28=bound_ylo
 9440 base!32=bound_xhi
 9450 base!36=bound_yhi
 9460 ENDPROC
 9470 :
 9480 DEF PROCobjectbound
 9490 type=FNword
 9500 size=FNword
 9510 CASE type OF
 9520 WHEN 0:ptr+=size-8
 9530 WHEN 1,5,9,10:PROCgetboundbox
 9540 WHEN 2:PROCcalcboundbox
 9550 WHEN 5:PROCgetboundbox
 9560 WHEN 6:PROCgroupbound
 9570 WHEN 7:PROCtaggedbound
 9580 OTHERWISE:ERROR 0,"Unknown draw ob
ject: "+STR$type
 9590 ENDCASE
 9600 IF type<>0 THEN
 9610 IF obj_xlo<bound_xlo bound_xlo=obj
_xlo
 9620 IF obj_xhi>bound_xhi bound_xhi=obj
_xhi
 9630 IF obj_ylo<bound_ylo bound_ylo=obj
_ylo
 9640 IF obj_yhi>bound_yhi bound_yhi=obj
_yhi
 9650 ENDIF
 9660 ENDPROC
 9670 :
 9680 DEF PROCgetboundbox
 9690 PROCgetbox(obj_xlo,obj_ylo,obj_xhi
,obj_yhi)
 9700 ptr+=(size-6*4)
 9710 ENDPROC
 9720 :
 9730 DEF PROCcalcboundbox
 9740 bounds=base+ptr
 9750 PROCgetbox(z,z,z,z)
 9760 pathend=ptr-6*4+size
 9770 fillcol=FNword
 9780 linecol=FNword
 9790 linewidth=FNword
 9800 linestyle=FNword
 9810 dash=FNdashpat
 9820 IF linestyle AND 64 THEN style=2 E
LSE style=0
 9830 SYS "Draw_ProcessPath",base+ptr,(%
01111<<27) OR %110000 OR style,0,0,linew
idth,caps,dash,bounds OR (1<<31)
 9840 obj_xlo=bounds!0
 9850 obj_ylo=bounds!4
 9860 obj_xhi=bounds!8
 9870 obj_yhi=bounds!12
 9880 ptr=pathend
 9890 ENDPROC
 9900 :
 9910 DEF PROCgroupbound
 9920 LOCAL bound_xlo,bound_ylo,bound_xh
i,bound_yhi,end
 9930 bound_xlo=1E38:bound_xhi=-1E38
 9940 bound_ylo=1E38:bound_yhi=-1E38
 9950 PROCgetbox(z,z,z,z)
 9960 name$=FNstring(12)
 9970 end=ptr-12-6*4+size
 9980 REPEAT
 9990 PROCobjectbound
10000 UNTIL ptr=end
10010 obj_xlo=bound_xlo:obj_ylo=bound_yl
o
10020 obj_xhi=bound_xhi:obj_yhi=bound_yh
i
10030 ENDPROC
10040 :
10050 DEF PROCtaggedbound
10060 ident=FNword
10070 PROCobjectbound
10080 ENDPROC
```

Listing 1

```
   10 REM >MakeApp
   20 REM Creates !Stretch data files
   30 REM by Chris Ruseman
   40 REM for Archimedes only
   50 REM (c) BAU September 1990
   60 :
   70 free%=(HIMEM-END-&8000) AND &FFFFF
000
   80 DIM w% free%
   90 READ app$
  100 REPEAT
  110 PROCins(app$)
  120 INPUT"Enter destination directory:
 "app$
  130 IF app$="" app$="@"
  140 SYS "XOS_File",5,app$ TO type%
  150 UNTIL type%=2
  160 REPEAT
  170 READ file$
  180 IF file$<>"*" THEN
  190 file$=app$+"."+file$
  200 PRINT"Creating file """file$""""
  210 READ load%,exec%,olen%,attrib%
  220 p%=0
  230 d$=""
  240 dl%=1
  250 WHILE p%<olen%
```

Continued ▶

◀ Continued

```
260 b%=FNb
270 IF b%=130:p%?w%=FNb:p%+=1
280 IF b%>=131 AND b%<=162 THEN
290 n%=b%-128
300 f%=p%-FNb
310 FOR i%=0 TO n%-1
320 ?(w%+p%+i%)=?(w%+f%+i%)
330 NEXT
340 p%+=n%
350 ENDIF
360 IF b%<130 OR b%>162 THEN
370 p%?w%=b%:p%+=1
380 ENDIF
390 ENDWHILE
400 SYS "OS_File",0,file$,,,w%,w%+p%
410 SYS "OS_File",1,file$,load%,exec%,
,attrib%
420 ENDIF
430 UNTIL file$="*"
440 PRINT'"Files created"
450 END
460 :
470 DEF FNb
480 LOCAL b%,c1%,c2%,i%
490 IF d$="" THEN
500 READ d$,c1%
510 c2%=0
520 FOR i%=1 TO LEN(d$)/2
530 c2%+=EVAL("&"+MID$(d$,2*i%-1,2))
540 NEXT
550 IF c1%<>(c2% MOD 100) PRINT"Error
in DATA line ";dl%:END
560 dl%+=1
570 ENDIF
580 b%=EVAL("&"+LEFT$(d$,2))
590 d$=MID$(d$,3)
600 =b%
610 :
620 DEF PROCins(i$)
630 LOCAL i%
640 FOR i%=1 TO LEN(i$)
650 SYS "OS_Byte",138,0,ASC(MID$(i$,i%
))
660 NEXT
670 ENDPROC
680 :
690 DATA $.!Stretch
700 DATA "!Boot"
710 DATA &FFFFEB42,&7C7EB1A0
720 DATA &20,&3
730 DATA 49636F6E53707269746573,39
740 DATA 203C4F626579244469723E,76
750 DATA 2E2187140A,44
760 DATA "!Run"
770 DATA &FFFFEB42,&7E9994A7
780 DATA &D0,&3
790 DATA 7C205374726574636820 0A,31
800 DATA 7C204443412F444C203139,85
810 DATA 38390A0A536574881C2444,1
820 DATA 6972203C4F626579840A3E,14
830 DATA 0A2A49636F6E5370726974,75
840 DATA 6573203C8B253E2E218817,84
850 DATA 0A2A524D456E7375726520,69
860 DATA 436F6C6F75725472616E73,48
870 DATA 20302083184C6F61648338,38
880 DATA 797374656D24506174683E,57
890 DATA 4D6F64756C65732E862B73,67
900 DATA 0A57696D70536C6F74202D,18
910 DATA 6D696E2039364B83096178,99
920 DATA 84098358756E8B8D2E2183,77
930 DATA 10496D61676520252A300A,68
940 DATA "!Sprites"
950 DATA &FFFFF942,&7E215C45
960 DATA &2E0,&3
970 DATA 0100000108304E4020000,82
980 DATA D48304217374726574636 8,45
990 DATA 83170004871C840C078328,43
1000 DATA 2C832C8083310C83347777,60
1010 DATA 77BBBBBBBBB7BB830977B7,79
1020 DATA BB7B7787280000B0831889,72
1030 DATA 0D008297829982998 29983,74
1040 DATA 20842CBBBB0B0070798370,69
1050 DATA B7B784167983438297790 7,48
1060 DATA BBBB7B86148511844E8451,24
1070 DATA 7984287BBB829B790700B0,92
1080 DATA 0B847E778299B9829BB983,57
1090 DATA AC8375861464640477829 9,80
1100 DATA BBBB881483630B40707040,23
1110 DATA 73846C8928007000474007,86
1120 DATA 748B1482870800706767 66,68
1130 DATA 778828839B790780087083,88
1140 DATA E107748297838D84DC8578,6
1150 DATA 82880070040074728299B9,80
1160 DATA BB7084F0B98BA08314B084,14
1170 DATA 2884DC891482990B8514BB,83
1180 DATA BB83BF85F0829B829979B7,54
1190 DATA 57865086FF83EB82978B14,96
1200 DATA 84EF842986F783F083F384,2
1210 DATA 06F0FF8A0C8913FF901584,59
1220 DATA 1391159539852988549214,54
1230 DATA F00F8B28877EFF8D140F86,60
1240 DATA 998D2886A793289550A28C,53
1250 DATA A2CA91F084DF93F48AEC00,69
1260 DATA "Templates"
1270 DATA &FFFFEC42,&7E1B0992
1280 DATA &51F,&3
1290 DATA FFFFFFFF00000000830485,88
1300 DATA 0774830D44010000018315,89
1310 DATA 736176650D871DB8831452,25
1320 DATA 87186D61676E6966696572,5
1330 DATA 831D0A030000588341861 8,15
1340 DATA 696E0D871862831 8BD8748,36
1350 DATA 696E666F8848846C5E8334,53
1360 DATA 0402000054040000AC8308,5
1370 DATA 8880440700001200038284,22
1380 DATA 070207010C0E0C8697FC83,23
1390 DATA A00586A23D84A930869C84,93
1400 DATA B45383A02061733A0D0D0D,95
1410 DATA 65833B00C083C96083D1EE,89
1420 DATA 83D1829083D93D829001C7,97
1430 DATA 4F4B0D7469746C65643E0D,88
1440 DATA F61083D8B883F116837CE4,70
1450 DATA 83F9116100173883EC8333,22
1460 DATA FF1E83FF0A8740BA8840F1,7
1470 DATA 000743872084F984E8A683,83
1480 DATA 60829C83F0EC83683A6000,78
1490 DATA 1766696C655F6166660D6F,59
1500 DATA 6E0D829A83EC0883804A83,46
1510 DATA F8388480600 0D73C556E88,66
1520 DATA 80E64484CFFEFFFFF483F3,47
1530 DATA 2C93206E83F20C848C83E1,46
1540 DATA 3C934046836C206E616D65,29
1550 DATA 83F2DC83CCE883D0EC83CC,70
1560 DATA 6883D083FF005483F85807,87
1570 DATA 0000120001828407020700,97
1580 DATA 040D8719FC83C00583F483,63
1590 DATA E43D83F0842E860783A887,13
1600 DATA E01183FC833B0048871882,75
1610 DATA 8483EC2883F031F3000742,75
1620 DATA 83FC4483D48467828C8738,90
1630 DATA C88820F100074983F04B87,70
1640 DATA 201283E41483E83A83EC84,49
1650 DATA F03D200017828B0D89E485,36
1660 DATA 20E883FC8420188720828A,70
1670 DATA 8B20D8874084A194408420,55
1680 DATA 844084C194407887D88294,82
1690 DATA 87C0010300D75087E40C83,32
1700 DATA FB4D61676E69666965720D,78
1710 DATA 390D61302D398607390D3A,86
1720 DATA 0D84DEB083EADA83E77403,7
1730 DATA 87E783F23C0784FA01FF07,51
1740 DATA 0207000301844483FFFC83,82
1750 DATA 8205866B3D84AE6085B185,82
1760 DATA 7C537472657463680D84EE,40
1770 DATA 84C96C83F2828484F68361,82
1780 DATA 5C882583FE408358120003,54
1790 DATA 82848358010C0E93588451,56
1800 DATA 308A587887C61383F60983,63
1810 DATA FAA483B13483D75483AC64,7
1820 DATA 83DF3D3000B70D4B0D7469,68
1830 DATA 746C65837CFE829A83FECC,7
1840 DATA 83F77683D983AFFF3D6100,63
1850 DATA 07828B87441483EC842082,60
1860 DATA 988720C887208293876 41A,24
1870 DATA 87208458844082948740A7,27
1880 DATA 87842887403087606087 60,12
1890 DATA BC87A41E83FA3E83FED083,84
1900 DATA B18488F883B9190000174E,35
1910 DATA 616D653A0D86A00E83F282,89
1920 DATA 9C8720C48720507572706F,20
1930 DATA 73832383C0844468874082,37
1940 DATA 908740417574686F723A0D,41
1950 DATA 88403887608480846056 65,62
1960 DATA 7273696F6E854041626F75,43
1970 DATA 742074686973207072 6F67,60
1980 DATA 72616D0D53747265746368,66
1990 DATA 0D4472617720466 96C6520,59
2000 DATA 871265720DA92042415520,30
2010 DATA 53657074656D6265722031,16
2020 DATA 3939300D0D,88
2030 DATA *
```

Listing 3

```
10 REM >Distort
20 REM by Chris Ruseman
30 REM for Archimedes Only
40 REM (c) BAU September 1990
50 :
60 MODE 12:OFF
70 ON ERROR MODE 0:REPORT:PRINT" at l
ine ";ERL:END
80 PROCinit
90 PROCbounding
100 PROCdraw(xys,xy())
110 REPEAT
120 MOUSE x,y,z
130 IF (z AND 4) THEN
140 IF corner=0 THEN
150 FOR i=1 TO 4
160 IF ABS(x-x(i))<16 AND ABS(y-y(i))<
16 corner=i
170 NEXT
180 ELSE
190 x(corner)=x
200 y(corner)=y
210 xy2()=xy()
220 PROCdistort(xys,xy2())
230 PROCdraw(xys,xy2())
240 ENDIF
250 ELSE
260 corner=0
270 ENDIF
280 UNTILO
290 :
300 DEF PROCinit
310 xys=8
320 DIM xy(xys,1),x(4),y(4),xy2(xys,1)
330 xy()=200,100, 500,200, 600,100, 50
0,300, 600,500, 400,400, 200,500, 300,20
0, 200,100
340 SYS 6,113,1
350 SYS 6,112,2
360 bank=2
370 corner=0
380 *POINTER 1
390 ENDPROC
400 :
410 DEF PROCbounding
420 xlo=1E38:ylo=1E38:xhi=-1E38:yhi=-1
E38
430 FOR i=0 TO xys
440 IF xy(i,0)<xlo xlo=xy(i,0)
450 IF xy(i,1)<ylo ylo=xy(i,1)
460 IF xy(i,0) > xhi xhi=xy(i,0)
470 IF xy(i,1) > yhi yhi=xy(i,1)
480 NEXT
490 x(1)=xlo:y(1)=ylo
500 x(2)=xhi:y(2)=ylo
510 x(3)=xhi:y(3)=yhi
520 x(4)=xlo:y(4)=yhi
530 ENDPROC
540 :
550 DEF PROCdraw(n,a())
560 CLS
570 GCOL 0,7
580 FOR i=0 TO n
590 x=a(i,0)
600 y=a(i,1)
610 IF i=0 MOVE x,y ELSE DRAW x,y
620 NEXT
630 GCOL 3,2
640 MOVE x(1),y(1)
650 DRAW x(2),y(2)
660 DRAW x(3),y(3)
670 DRAW x(4),y(4)
680 DRAW x(1),y(1)
690 WAIT
700 SYS 6,113,bank
710 SYS 6,112,3-bank
720 bank=3-bank
730 ENDPROC
740 :
750 DEF PROCdistort(n,a())
760 FOR i=0 TO n
770 x=a(i,0)
780 y=a(i,1)
790 px=(x-xlo)/(xhi-xlo)
800 py=(y-ylo)/(yhi-ylo)
810 xx=x(1)+px*(x(2)-x(1))+py*(x(4)-x(
1)+px*(x(3)-x(4)-x(2)+x(1)))
820 yy=y(1)+px*(y(2)-y(1))+py*(y(4)-y(
1)+px*(y(3)-y(4)-y(2)+y(1)))
830 a(i,0)=xx
840 a(i,1)=yy
850 PRINT
860 NEXT
870 ENDPROC
```


Listing 1

```
10 REM >Arm Programming
20 REM Print out all SWI numbers and
names
30 REM Jason O'Broin
40 REM for Arc and A3000 only
50 REM (c) BAU Sep 1990
60 :
70 DIM code 300
80 FOR X=0 TO 3 STEP 3
90 P%=code
100 [OPT X
110 MOV R4,#0                     \ This
register contains the SWI number
120 :                             \ we ar
e interested in
130 .getswi
140 MOV R0,R4                     \ Move
r4 into r0 (as the SWI call
150 :                             \ requi
res the number to be in r0)
160 CMP R0,#&100000               \ Have
we reached SWI number &100000
170 MOVGE PC,R14                  \ If so
then exit (r14 contains old
180 :                             \ value
of program counter)
190 ADR R1,buffer                 \ Addre
ss of buffer for string
200 ADR R6,bad1                   \ Point
er to a SWI name not to print
210 ADR R7,bad2                   \ As ab
ove
220 MOV R2,#50                    \ Maxim
um space in buffer
230 SWI "OS_SWINumberToString" \ Conve
rt SWI number to string
240 MOV R5,#0
250 LDRB R8,[R1,R5]               \ Get t
he first byte of the string
260 CMP R8,#ASC"X"                \ Is it
an X?
270 ADDNE R6,R6,#1                \ If No
t then ignore first character
280 :                             \ of th
e SWI not to print
290 .check1                       \ Check
if SWI name is the same as
300 :                             \ User
which we don't want to print
310 LDRB R8,[R6,R5]
320 LDRB R9,[R1,R5]
330 CMP R8,R9                     \ Check
whether characters of SWI
340 :                             \ name
and bad string match
350 ADDEQ R5,R5,#1
360 BNE chk                       \ If no
t then get on and print
370 CMPEQ R8,#0                   \ Are w
e at end of string?
380 BNE check1                    \ If no
t then go around again
390 ADDEQ R4,R4,#64               \ If so
, then ignore the whole chunk
400 BEQ getswi
410 :
420 .chk
430 MOV R5,#0                     \ Simil
ar to check1
440 LDRB R8,[R1,R5]
450 CMP R8,#ASC"X"
460 ADDNE R7,R7,#1
470 :
480 .check2
490 LDRB R8,[R7,R5]
500 LDRB R9,[R1,R5]
510 CMP R8,R9
520 ADDEQ R5,R5,#1
530 BNE chk2
540 CMPEQ R8,#0
550 BNE check2
560 ADDEQ R4,R4,#1                \ but t
his time if the two strings
570 :                             \ match
then just ignore this one
580 BEQ getswi
590 :
600 .chk2                         \ Now p
rint out information
610 ADR R1,numberbuff             \ Point
er to another buffer
620 MOV R2,#8
630 SWI "OS_ConvertHex6"          \ Conve
rt SWI number to hex
640 SWI "OS_Write0"               \ and p
rint
```

Continued ▶

IMAGE PROCESSING

◀ Continued

```
  650 SWI 256+32                    \ a spa
ce (256+character number)
  660 ADR R0,buffer                 \ point
er to SWI name buffer
  670 SWI "OS_Write0"               \ and p
rint
  680 SWI "OS_NewLine"              \ a new
line
  690 ADD R4,R4,#1                  \ incre
ment swi number
  700 B getswi                      \ ... a
nd around again
  710 :
  720 .bad1 EQUS "XUser"
  730 EQUB 0
  740 .bad2 EQUS "XOS_Undefined"
  750 EQUB 0
  760 .numberbuff EQUS STRING$(8," ")
  770 .buffer EQUS STRING$(50," ")
  780 ]NEXT
  790 CALL code
```

Listing 1

```
   1Ø REM Image processing #4
   2Ø REM Interpolation
   3Ø REM by David Knell
   4Ø REM for all Acorn machines
   5Ø REM (c) BAU September 199Ø
   6Ø :
   7Ø MODE 1
   8Ø DIM world%(4,4)
   9Ø REPEAT
  1ØØ CLS
  11Ø x_off=RND(1)/2
  12Ø y_off=RND(1)/2
  13Ø thresh%=4Ø
  14Ø PROCplaceobject(x_off,y_off)
  15Ø PROCshowobject(x_off,y_off)
  16Ø PRINT TAB(Ø,29) "Area by straight
thresholding is ";FNstraightarea(thresh%
)
  17Ø PRINT "Area by interpolation is ";
FNinterpolate(thresh%)
  18Ø PRINT "Press a key to do again; Q
to finish";
  19Ø A$=GET$
  2ØØ UNTIL A$="Q" OR A$="q"
  21Ø END
  22Ø :
  23Ø REM This procedure places a 2x2 sq
uare of grey level 99 in
  24Ø REM the centre of our 5x5 "world".
 X and Y offsets (in the range Ø-Ø.5)
  25Ø REM may be specified.
  26Ø :
  27Ø DEF PROCplaceobject(x_off,y_off)
  28Ø LOCAL x%,y%
  29Ø FOR x%=Ø TO 4
  3ØØ FOR y%=Ø TO 4
  31Ø world%(x%, y%)=Ø
  32Ø NEXT y%
  33Ø NEXT x%
  34Ø :
  35Ø world%(1,1)=99*(1-x_off)*(1-y_off)
  36Ø world%(2,1)=99*(1-y_off)
  37Ø world%(3,1)=99*x_off*(1-y_off)
  38Ø world%(1,2)=99*(1-x_off)
  39Ø world%(2,2)=99
  4ØØ world%(3,2)=99*x_off
  41Ø world%(1,3)=99*(1-x_off)*y_off
  42Ø world%(2,3)=99*y_off
  43Ø world%(3,3)=99*x_off*y_off
  44Ø ENDPROC
  45Ø :
  46Ø REM Draw the object over a pixel g
rid
  47Ø :
  48Ø DEF PROCshowobject(x_off,y_off)
  49Ø LOCAL x%,y%
  5ØØ GCOL Ø,3
  51Ø FOR x%=Ø TO 5
  52Ø MOVE 1ØØ+1ØØ*x%,1ØØ
  53Ø DRAW 1ØØ+1ØØ*x%,6ØØ
  54Ø MOVE 1ØØ,1ØØ+1ØØ*x%
  55Ø DRAW 6ØØ,1ØØ+1ØØ*x%
  56Ø NEXT x%
  57Ø :
  58Ø GCOL 1,1
  59Ø MOVE 2ØØ+1ØØ*x_off,2ØØ+1ØØ*y_off
  6ØØ MOVE 4ØØ+1ØØ*x_off,2ØØ+1ØØ*y_off
  61Ø PLOT 85,2ØØ+1ØØ*x_off,4ØØ+1ØØ*y_of
f
  62Ø PLOT 85,4ØØ+1ØØ*x_off,4ØØ+1ØØ*y_of
f
  63Ø VDU 5
  64Ø GCOL 1,3
  65Ø FOR x%=Ø TO 4
  66Ø FOR y%=Ø TO 4
  67Ø MOVE 12Ø+1ØØ*x%, 165+1ØØ*y%
  68Ø PRINT ;world%(x%, y%)
  69Ø NEXT y%
  7ØØ NEXT x%
  71Ø VDU 4
  72Ø ENDPROC
  73Ø :
  74Ø REM Calculate the area of the obje
ct without interpolation
  75Ø :
  76Ø DEF FNstraightarea(thresh%)
  77Ø LOCAL x%,y%,area%
  78Ø area%=Ø
  79Ø FOR x%=Ø TO 4
  8ØØ FOR y%=Ø TO 4
  81Ø IF world%(x%,y%)>thresh% THEN area
%=area%+1
  82Ø NEXT y%
  83Ø NEXT x%
  84Ø =area%
  85Ø :
  86Ø REM Calculate the area of the obje
ct with interpolation
  87Ø :
  88Ø DEF FNinterpolate(thresh%)
  89Ø LOCAL x%,y%,xx,yy,wx1,wx2,area
  9ØØ GCOL Ø,2
  91Ø area=Ø
  92Ø FOR x%=Ø TO 3
  93Ø FOR y%=Ø TO 3
  94Ø FOR x=Ø TO Ø.99 STEP Ø.2
  95Ø wx1=world%(x%,y%)*(1-x)+world%(x%+
1,y%)*x
  96Ø wx2=world%(x%,y%+1)*(1-x)+world%(x
%+1,y%+1)*x
  97Ø FOR y=Ø TO Ø.99 STEP Ø.2
  98Ø IF (wx1*(1-y)+wx2*y)>thresh% THEN
area=area+1/25:PLOT69,15Ø+(x%+x)*1ØØ,15Ø
+(y%+y)*1ØØ
  99Ø NEXT y
 1ØØØ NEXT x
 1Ø1Ø NEXT y%
 1Ø2Ø NEXT x%
 1Ø3Ø =area
```

Listing 2

```
   1Ø REM Image Processing # 4
   2Ø REM Charactor recognition
   3Ø REM by David Knell
   4Ø REM for all Acorn machines
   5Ø REM (c) BAU September 199Ø
   6Ø :
   7Ø MODE 1
   8Ø PROCsetuptemplates
   9Ø PRINT TAB(Ø, 1Ø) "THIS IS TEXT FOR
 THE RECOGNISER"
  1ØØ PROCrecognise
  11Ø END
  12Ø :
  13Ø REM Set up templates - just print
A-Z across the top of the screen,
  14Ø REM from where the recogniser can
read the patterns.
  15Ø :
  16Ø DEF PROCsetuptemplates
  17Ø PRINTTAB(Ø,Ø) "ABCDEFGHIJKLMNOPQRS
TUVWXYZ"
  18Ø ENDPROC
  19Ø :
  2ØØ REM Recognise a character, by pixe
l-by-pixel comparison and keeping a
  21Ø REM score for each template
  22Ø :
  23Ø DEF FNrecognisechar(x%,y%)
  24Ø LOCAL ch%,tx%,ty%,xx%,yy%,minerr%,
minch$,err%
  25Ø minerr%=1ØØØØØ
  26Ø FOR ch%=Ø TO 26
  27Ø ty%=992
  28Ø tx%=ch%*32:REM Find template chara
cter
  29Ø :
  3ØØ err%=Ø
  31Ø FOR xx%=Ø TO 28 STEP 4
  32Ø FOR yy%=Ø TO 28 STEP 4
  33Ø err%=err%-(POINT(tx%+xx%,ty%+yy%)<
>POINT(x%+xx%,y%+yy%))
  34Ø NEXT yy%
  35Ø NEXT xx%
  36Ø :
  37Ø PRINT TAB(Ø, 13) "Char ";CHR$(ch%+
65);" err ";err%;"  "
  38Ø IF err%<minerr% THEN minerr%=err%:
minch$=CHR$(ch%+65)
  39Ø IF minch$=CHR$(65+26) THEN minch$=
" "
  4ØØ PRINT TAB(Ø, 14) "Best match so fa
r: ";minch$
  41Ø NEXT ch%
  42Ø =minch$
  43Ø :
  44Ø REM Recognise the whole line of te
xt, and attempt to reproduce it undernea
th
  45Ø REM itself.
  46Ø :
  47Ø DEF PROCrecognise
  48Ø FOR i%=Ø TO 39
  49Ø ch$=FNrecognisechar(i%*32,672)
  5ØØ PRINT TAB(i%,11)ch$
  51Ø NEXT i%
  52Ø ENDPROC
```

Listing 3

```
   1Ø REM Image processing #4
   2Ø REM Listing 3
   3Ø REM Label detecting
   4Ø REM by David Knell
   5Ø REM for all Acorn machines
   6Ø REM (c) BAU September 199Ø
   7Ø :
   8Ø REPEAT
   9Ø MODE 1
  1ØØ @%=&3ØA
  11Ø PROCdrawbottle
  12Ø x_off=RND(1)*4Ø-2Ø
  13Ø y_off=RND(1)*4Ø-2Ø
  14Ø rot=RND(1)*2Ø-1Ø
  15Ø PROCdrawlabel(x_off,y_off,PI*rot/1
8Ø)
  16Ø PRINT TAB(Ø,Ø) "Offset x: ";x_off;
" y: ";y_off;" Rotation ";rot
  17Ø :
  18Ø REM Find the edge of the bottle
  19Ø :
  2ØØ PROCcheckline(5Ø,3ØØ,15Ø,3ØØ)
  21Ø botx = xx-1ØØ
  22Ø :
  23Ø REM Find the label on the bottle
  24Ø :
  25Ø PROCcheckline(15Ø+botx,212,25Ø+bot
x,23Ø)
  26Ø labx1=xx-(2ØØ+botx)
  27Ø PROCcheckline(15Ø+botx,388,25Ø+bot
x,37Ø)
  28Ø labx2=xx-(2ØØ+botx)
  29Ø PROCcheckline(3ØØ,35Ø,3ØØ,45Ø)
  3ØØ laby=yy-4ØØ
  31Ø labr=18Ø*ATN((labx2-labx1)/94)/PI
  32Ø PRINT TAB(Ø,1) "Checking routine f
ound:"
  33Ø PRINT "Offset x:";(labx1+labx2)/2;
" y: ";laby;" Rotation ";labr
  34Ø A$=GET$
  35Ø UNTIL A$="Q" OR A$="q"
  36Ø END
  37Ø :
  38Ø REM Draw the bottle on-screen
  39Ø :
  4ØØ DEF PROCdrawbottle
  41Ø GCOL Ø,1
  42Ø MOVE 1ØØ,1ØØ
  43Ø MOVE 5ØØ,1ØØ
  44Ø PLOT 85,1ØØ,5ØØ
  45Ø PLOT 85,5ØØ,5ØØ
  46Ø PLOT 85,3ØØ,7ØØ
  47Ø ENDPROC
  48Ø :
  49Ø REM Draw the label on the bottle
  5ØØ :
  51Ø DEF PROCdrawlabel(x_off,y_off,rot)
  52Ø GCOL Ø,3
  53Ø MOVE 2ØØ+x_off-5Ø*SIN(rot), 2ØØ+y_
off-5Ø*SIN(rot)
  54Ø MOVE 4ØØ+x_off-5Ø*SIN(rot), 2ØØ+y_
off+5Ø*SIN(rot)
  55Ø PLOT 85,2ØØ+x_off+5Ø*SIN(rot), 4ØØ
+y_off-5Ø*SIN(rot)
  56Ø PLOT 85,4ØØ+x_off+5Ø*SIN(rot), 4ØØ
+y_off+5Ø*SIN(rot)
  57Ø ENDPROC
  58Ø :
  59Ø REM Look along a given checkline u
ntil an edge is found
  6ØØ :
  61Ø DEF PROCcheckline(x1%,y1%,x2%,y2%)
  62Ø len=SQR((x2%-x1%)^2+(y2%-y1%)^2)
  63Ø xx=x1%:mx=(x2%-x1%)/len
  64Ø yy=y1%:my=(y2%-y1%)/len
  65Ø col%=POINT(x1%,y1%)
  66Ø FOR i%=Ø TO len
  67Ø IF POINT(xx, yy) <> col% THEN ENDP
ROC
  68Ø xx=xx+mx
  69Ø yy=yy+my
  7ØØ NEXT i%
  71Ø xx=-1
  72Ø yy=-1
  73Ø ENDPROC
```

AMPLE LISTING

```
"RUN" []        "cur?" []  "footer" []
"keyout" []   "lr" []    "wait" []
"switchstate" []

"RUN" [footer MENUDISP
%   'Ample Album' Auto Selection
%
%title1   % "title1" lr
%title2   % "title2" lr
%title3   % "title3" lr
%title4   % "title4" lr
MENU
]

"cur?" [ 0 134 &FFF4 CODE #2 #B12 &FF AND
]

"footer" [ 7 MODE
READY
1 P( wait cur?
   REP( REP( OFF switchstate )UNTIL( #2
            142 keyout IDLE
            cur? #2121 #= )UNTIL( #12 #2 wait
            )REP #2
        REP( OFF switchstate )UNTIL( #2
            143 keyout IDLE
            cur? #2121 #= )UNTIL( #12 #2 wait
            )REP #2
        switchstate )UNTIL(
  )REP #2 13 keyout
)P
23 FOR( NL )FOR DISPLAY
%Press switch or SHIFT key to select
]

"keyout" [ #B12 138 &FFF4 CODE #2 #2
]

"lr" [
"RUN ~w""jukebox""LOAD RUN" $+
"LOAD""~w""[REP(-1QKEY0 128 &FFF4 CODE#2
3AND0#=NOT OR )UNTIL(IDLE)REP]" $+
]

"switchstate" [ -1 QKEY   % SHIFT key
 0 128 &FFF4 CODE #2 3 AND % buttons
0 #= NOT
OR
]

"wait" [ 200 REP( switchstate )UNTIL(
                 1 #- #11 0 #< )UNTIL( IDLE )REP #2
]
```

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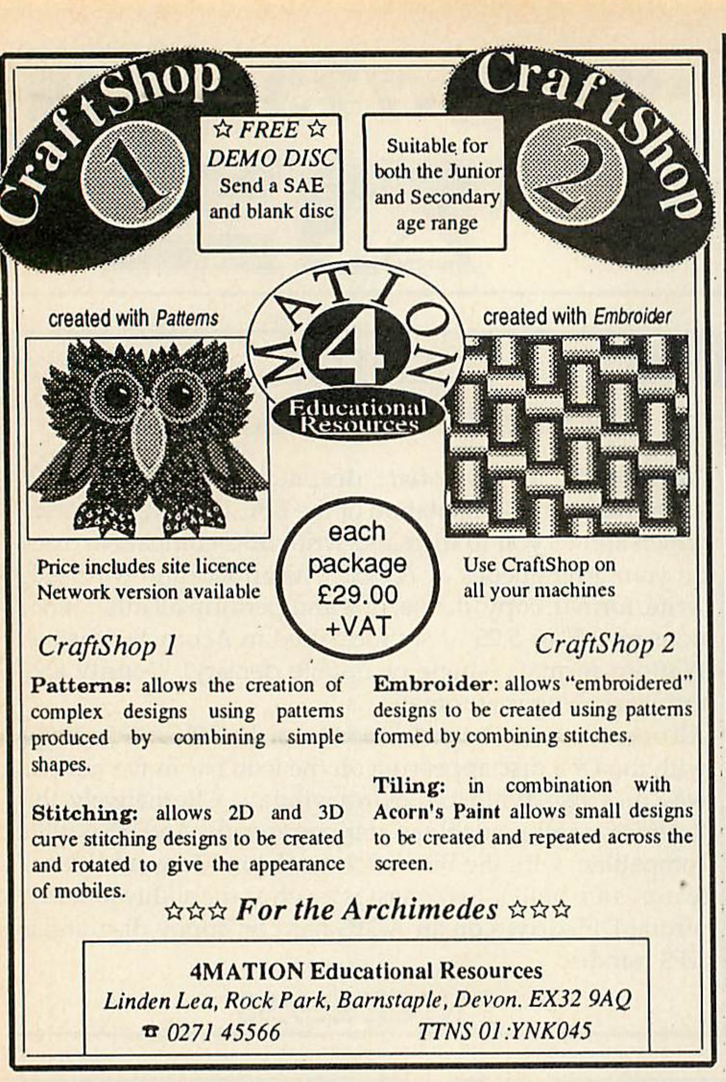
7th - 9th September

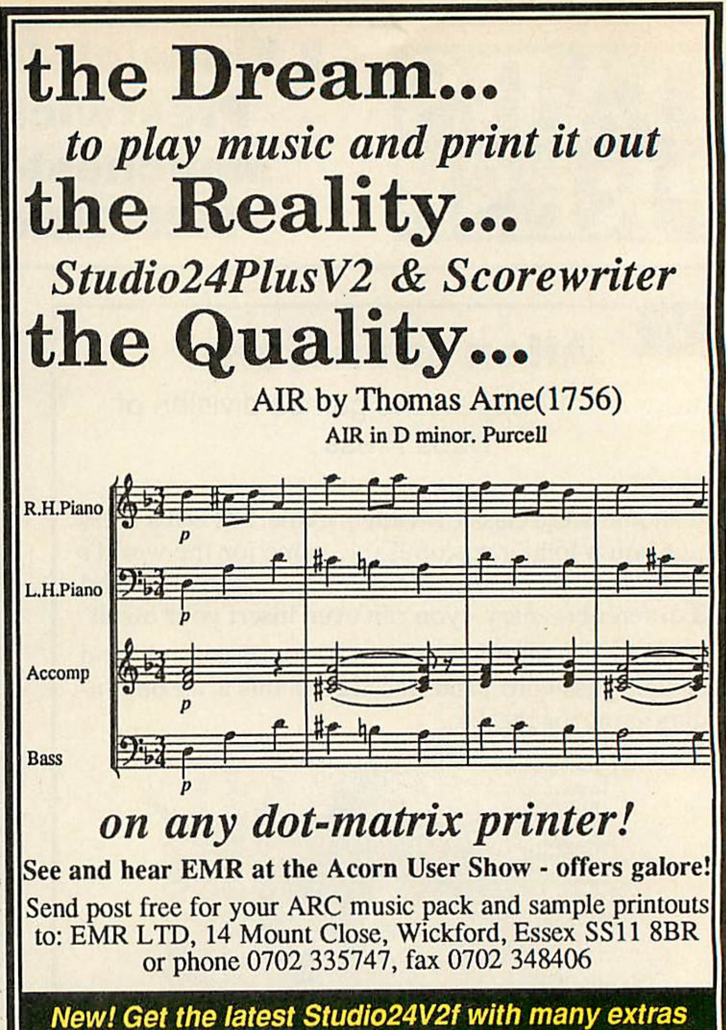


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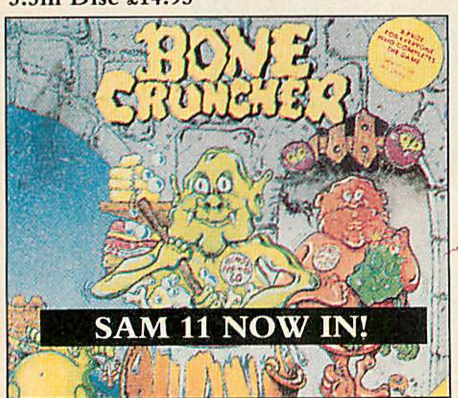
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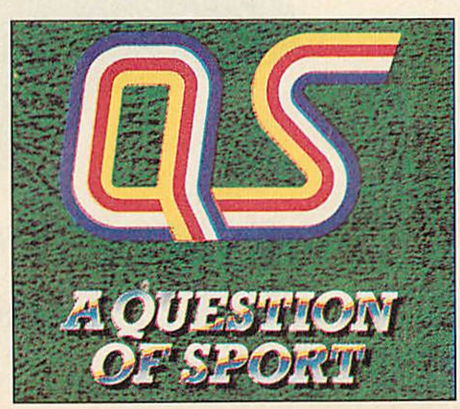
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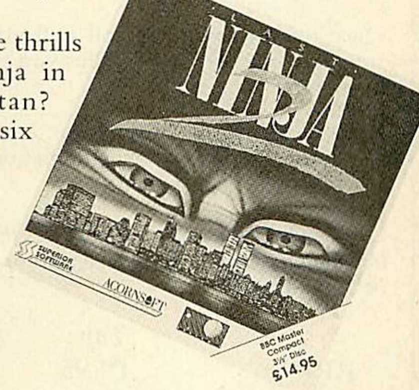
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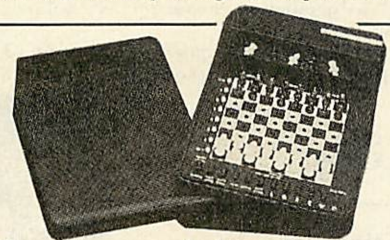
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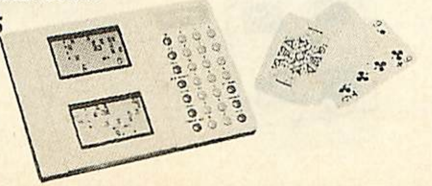
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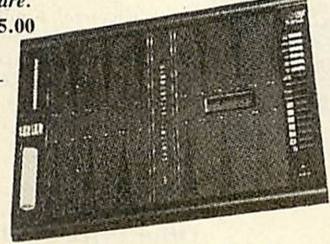
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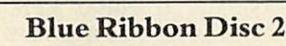
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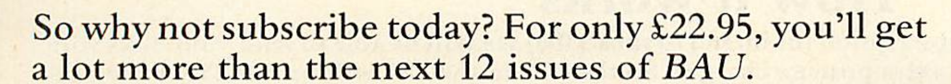
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We are producing this offer at such a low price as a special reader service and there is no time limit or closing date. We hope that in the months and years to come you will make use of, and enjoy, this service which provides a valuable addition to your BBC/Acorn software collection.

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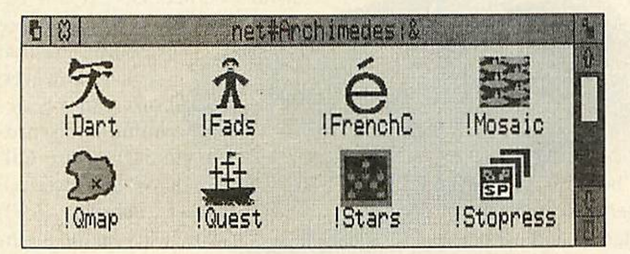


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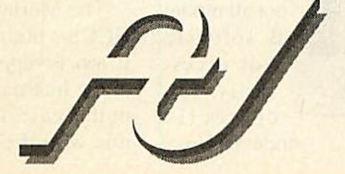


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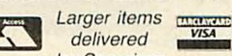
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AUGMENTING THE ARC

The mark of a classic computer is its expandability and, as CHRIS DRAGE finds, the A3000 seems set to follow the lead of the Beeb, Apple II and IBM PC

One of the delights of being an A3000 owner is that the system can be expanded in a number of ways to suit the user's specific requirements. This feature, embodied in the aged model B, was undoubtedly responsible for its undying popularity. Acorn, sensibly realising this, designed the A3000 to encourage third party companies to provide additional bits and pieces to help the consumer to arrive at the specification they desire. A point has been reached where the A3000 can be expanded to include four floppy disc drives and a 20+Mb hard disc of up to 20Mb, up to 4Mb of Ram and user/analogue ports or user/MIDI ports. The February issue of *BAU* covered the A3K1, A3K2 and A3K3 add-ons (Pres), a hard disc upgrade (DA Computers) and disc interfaces (CJE Micros, DA Computers)

A second disc drive means good disc management. Furthermore, by choosing a 5.25in floppy drive, the user gains access to a vast amount of MS Dos software using the *PC Emulator* and access to existing BBC software via *65Host*.

Pres is a company that aims at providing a complete upgrade path for the A3000 (*BAU*, February 1990). Its A3K6 disc interface is a trouble-free means of connecting up to three additional 3.5in or 5.25in floppy drives to the A3000. The Pres interface also offers direct access to files stored on DFS discs. The disc interface is correctly buffered and mounts on the internal podule sockets.

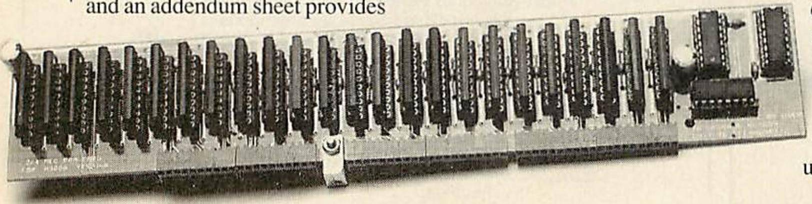
All the sockets are repeated on top of the A3K6 and you enjoy the ability to add a Pres internal mini-podule (user port/1MHz bus and the like). A lead connects to the computer's disc interface while the internal 3.5in drive connects to the A3K6. The whole operation is quite quick and simple. The interface has a back plate which is secured in place of the A3000's blanking plate. Links on the interface offer further compatibility with certain makes of floppy drive and an addendum sheet provides details on the various known quirks. After installation, all that remains to do is issue a *CONFIGURE FLOPPIES 2 and reset the computer.

The software provided is supplied on Rom and controls the drive-latch value and the stepping rate. The command *STATUS reveals the default values as DRIVELATCH 0 1 2 3 8. By altering the value, an external drive can be recognised as :0 thus permitting a model B-type SHIFT-BREAK autoboot. Both single (80 track) and double (40 track) stepping rates are available.

The drivelatch settings are stored in Cmos Ram, so are always selected on start up.

A further advantage of the Pres interface over its rivals is its ability to expand the on-board software. The A3K12 has additional software supplied on both Rom and disc which permits DFS discs to be read or written to and even allows protected DFS software to be run under the *65Host* emulator.

In short, A3K6 together with A3K12 effectively turns your A3000 into a model B. In addition, the disc contains *!DFSFiler*, a program which can for example, transfer *View/Viewsheet/Viewstore* files directly from DFS into *Pipedream*. The *65HostDFS* copes well with most protected discs. All the heavily protected Sherston and 4Mation 5.25in discs load and run without complaint, albeit a little slowly. Remember though that, even if it loads correctly with *65HostDFS*, not all model B software will necessarily run correctly under *65Host*.



Finding software that will run is a matter of trial and error.

Many schools, including those catering for special educational needs, will be interested in adding a user or analogue port to their A3000s. The user port is essential for input devices like Concept Keyboards and switch units (for special needs) and buffer boxes (for control technology).

The analogue port will become increasingly important since the Technology National Curriculum (AT 5) emphasises so much data logging and monitoring work. Two companies that are currently offering a combination of these important model B-style ports are HCCS Associates and Morley Electronics.

The HCCS user/analogue port podule is a well-constructed mini-podule which fits neatly in the A3000's internal expansion socket. Of necessity, it will displace any disc interface residing in that socket; however, both can be accommodated providing you use CJE Micros' disc interface (*BAU*, February 1990) which sits on the motherboard's IDC disc socket. The port's pin connections are identical with those on the model B and Master 128 and respond according to Acorn's specification for the earlier computers. However, the actual analogue connector is an Archimedes' 15-pin, I/O podule type. Thus any eight-bit software 'legally' written in Basic should operate the ports in the same manner providing there is no direct memory addressing. It is important that the correct *FX/OSBYTE calls are used. Similarly, the analogue port accepts the usual ADVAL/OSBYTE commands.

The Morley card is virtually identical to HCCS's both physically and electronically. It, too, is very well engineered, fitting snugly in the internal expansion socket. However, in this case, the user port is more compatible with the Archimedes I/O podule than

the Beeb/Master equivalent. The analogue port is 100 percent compatible and, again, uses a 15-pin connector. The comments about programming the HCCS unit relate to the Morley card as well. In addition, this card supports a IIC bus connector primarily intended for the connection of existing and future Morley products like teletext receivers. Any IIC device (such as a speech synthesiser) may be connected to this bus.

The accompanying handbook is a model of clarity, leaving no stone unturned. The extra versatility of this expansion card is reflected in its higher cost.

In common with the A410, the A3000's memory is designed to be upgraded. As a result there is no recourse to soldering, flying leads or specialised tools; it is a simple matter of plugging a Ram expansion board onto four SIL connectors on the motherboard.

But why add more Ram? Here are some of the major advantages:

- High-level languages like C can be run.
- Faster printing can be achieved in graphics modes using Risc OS printer drivers.
- As large a font cache as necessary can be allocated (this leads to a speed advantage).
- Multiple applications can be run (for example *Pipedream*, *!Draw* and *Graphbox* together).
- A large Ram disc can be set up for storing outline fonts and so on. This considerably enhances the efficiency of DTP work.
- Huge documents can be held in Ram.
- Larger screen modes can be used.

Even with an additional 1Mb, you will notice a considerable difference, while a 4Mb card dramatically contributes to operational efficiency. Every Ram card adds to the original 1Mb of Ram supplied in each machine. Where they differ is chiefly in how extra Ram is added.

Some 1Mb cards need to be 'part exchanged' for a 3Mb model, while others will accept additional chips in order to expand the memory. There appear to be no hard and fast rules on that one. All of the cards come with a single sheet giving the fitting instructions.

The cards from Acorn, CJE Micros, Watford Electronics and Technomatic all use edge-mounted cards which fit vertically. CJE Micros' card offers a link to deselect the board ('removing' the 1Mb Ram) in order to run certain pieces of 'fussy' software. To be fully effective you would need to add a flying lead as well as an external switch.

The CJE, Technomatic and Watford cards have spaces to accommodate the 3Mb upgrade (by adding soldered-in Ram chips plus components). The Watford card has an insulating strip to prevent the PCB from shorting out on the disc drive case and possesses a link to select either 1Mb or 3Mb of Ram, although this is not documented in any way. This four-layered board is cheaper than the competition (see June's advertised prices) yet is sturdy and well-built.

The card from Morley differs significantly in that it lies horizontally, is broader and has two plastic feet to ensure that the board is raised above the motherboard.

It is very well engineered but it needs to be further upgraded by the addition of Ram chips, although Morley is considering switching to a trade-in system of upgrading. The TechnoRam card is approximately 30mm longer than the other vertically mounted boards. It, too, is extremely well-built and possesses a bracket and a thick protective insulating pad to ensure the board remains rigid and less likely to damage the motherboard should it be accidentally knocked about.

One thing all these Ram expansion cards do have in common is reliability. They are all variations on a theme and your decision can be governed by price as much as anything. My favourites happen to be the TechnoRam and Morley cards.

All the Ram cards are very simple to fit, requiring nothing more than a small posidriver and a flat-bladed screwdriver together with a bit of care.

However, it is important to realise that by 'lifting the lid' you may invalidate Acorn's product warranty. If you are in any doubt at all about your situation it is advisable to approach an authorised dealer to perform the upgrade for you – although this may be at extra cost.

Pres Ltd, PO Box 319, Lightwater, Surrey GU18 5PW. Tel: (0276) 72046.
HCCS Associates Ltd, 575-583 Durham Road, Low Fell, Gateshead, Tyne & Wear NE9 5JJ. Tel: 091-487 0760.
Morley Electronics, Morley House, Off Norham Road, North Shields, Tyne & Wear NE29 7TY. Tel: 091-257 6355.
Acorn Computers Ltd, Fulbourn Road, Cherry Hinton, Cambridge CB1 4JN. Tel: (0223) 2452000
CJE Micros, 78 Brighton Road, Worthing, West Sussex BN11 2EN. Tel: (0903) 213361.
Technomatic, Techno House, 468 Church Lane, London NW9 8UF. Tel: 081-205 9558.
Watford Electronics, Jessa House, 250 Lower High Street, Watford, WD1 2AN. Tel: (0923) 37774.

PRICES AND SUPPLIERS

Supplier	User/Analogue port podule £	1Mb Ram board £	3Mb Ram board £	A3K6 £	A3K12 £
Pres	-	-	-	56.30	22.94
HCCS	51.75	-	-	-	-
Morley	79.35	113.85	-	-	-
Acorn	-	148.35	-	-	-
CJE	-	120.00	-	-	-
Technomatic	-	90.85	286.35	-	-
Watford	-	109.25	343.85	-	-

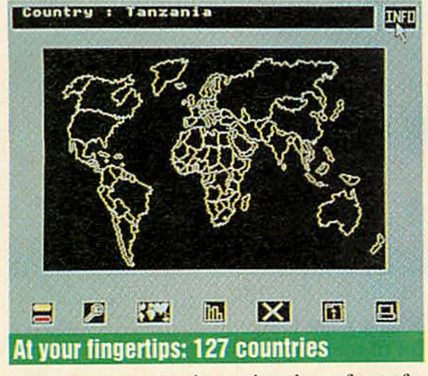
***These prices are, as far as we know, accurate at the time of going to press. However, such prices, particularly for Ram, fluctuate rapidly, so it's worth shopping around for the best deal.**

A WORLD OF INFORMATION

DAVE FUTCHER investigates a new geographical database package that puts the whole planet at your fingertips

It's not always easy to find detailed geographic and economic information to hand, and in today's ever-changing world, you may feel you need to. Help is at hand, though. With the publication of Owen Love's *World Map Study*, which is a graphical world database for the BBC micro, assistance is merely SHIFT-BREAK away. *World Map Study* provides a map-based world database for displaying and gathering geographical and environmental information. It contains information stored in 17 data categories for 127 individual countries. The data is as good and up-to-date as it can be, having been taken from *Global Statistics* produced by Brian Hudson and published by the Centre of Global Education in York.

World Map Study is extremely easy to use. It is not like most BBC databases as it uses the latest Windows, Icon, Mouse and Pointer (Wimp) environment. It is also graphics based, so by moving the pointer around the screen and clicking on any one of the 127 individual countries shown on a world map, the user can find statistics varying from the area of the country to its mortality rate within seconds. The way this program operates shows just how far software for the BBC micro has developed since 1982. But not every BBC user has a mouse, so the program can be run from the keyboard with the four cursor keys to simulate mouse movement. This is quite adequate but it can be speeded up by using SHIFT and a cursor key. Non-mousers have to use SPACE to do the clicking. Any user with an AMX Mouse Rom fitted into their BBC will have true mouse and pointer control.



At your fingertips: 127 countries

Moving the on-screen pointer over any country and pressing SPACE will put the name of the country into the information box at the top of the screen.

Detailed information on that country is then obtained by moving the pointer to the Info icon at the top right of the screen and pressing SPACE.

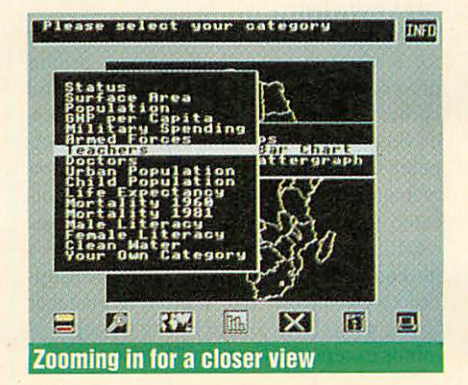
The information provided covers: surface area; population; GNP per capita; military spending; armed forces; teachers; doctors; urban population; child population; life expectancy; mortality 1960; mortality 1981; male literacy; female literacy; and clean water. In addition the capital city is given and the country's status – whether it's developed or developing.

As well as displaying the world map it is possible to display maps of the individual continents, with the exception of Antarctica. This is particularly useful when trying to select some of the smaller countries in crowded continents. Continent displays are achieved by using the enlarge icon to zoom in on a particular continent.

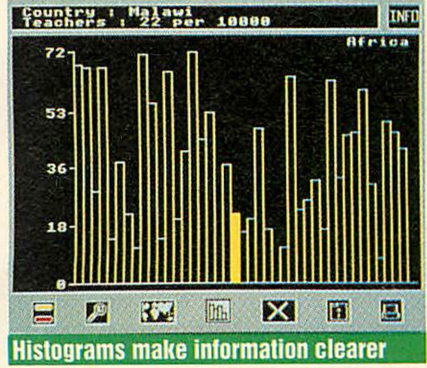
The program provides very good opportunities for the interrogation of the stored data. Answering detailed questions about national statistics would be impossible without the interrogation and graphing facilities available. The program's real power is seen when comparisons are made across individual continents or the whole world.

To make this possible three types of data plotting are available. As well as the usual plotting of data on a bar chart or a scattergraph, data can be plotted on maps with countries coloured in to show, for instance, the average value of gross national product (GNP) per capita for those countries with figures more or less than $8,000. The inclusion of the scattergraph option opens up all sorts of possibilities for the advanced use of the *World Map Study* package. Investigations can be made into such questions as how much longer people live in the richer countries, or the relationship between access to safe water and health.

It's all very well manipulating and displaying data on screen but, information at times is needed as hard copy. This presents no problem to *World Map Study*. If you have an Epson or compatible nine-pin dot matrix printer you can print any information you have on screen very easily. You merely take the pointer to the printer icon



Zooming in for a closer view



Histograms make information clearer

and press SPACE and confirm that this is what you want to print by pressing P. The screen dump is fast and clear, but the program's manual omits to tell you to ensure the computer is set not to send linefeeds.

Data soon becomes out of date and programs like this could become limited in use. The author has thought of this and a means of amending or editing old data is provided. The potential of the program is further enhanced by the possibility of using your own data categories rather than those selected by the author.

Conclusions

As well as providing a database of global information, *World Map Study* is an ideal package for enhancing a number of general and information technology skills. It offers first-rate opportunities for database interrogation or the manipulation of graphical output from a database, as well as the interpretation of information on maps, bar charts and scattergraphs.

World Map Study comes with a very useful handbook that clearly explains how to use all the features of the program.

Although the program is simple to operate through its icons and pointer, this nonetheless makes all the features clearer. I particularly liked the worked examples. Additionally, the handbook includes a series of ideas for its use by pupils or students. Teachers will find this invaluable.

World Map Study will undoubtedly help pupils or any user to question and make hypotheses about today's world.

World Map Study *is published by ESM Ltd, Duke Street, Wisbech, Cambs PE13 2AE. It is available for the BBC micro and Master series and costs £30*

THE THIRD WAVE

Can direct drive laser printing achieve the goal of more speed plus lower price? **GRAHAM BELL** investigates

There used to be two types of laser printer: the expensive laserjet and very expensive Postscript. Now 'direct drive' is here with the Calligraph ArcLaser and Computer Concepts' LaserDirect.

Every laser printer uses toner powder and a 'laser' to draw images onto a light-sensitive drum (like a photocopier drum); the difference is how the images are drawn.

With a normal laserjet printer, the Arc builds up a complete image of the page in Ram, a section at a time, then transfers the data for each section down the parallel cable to the printer. Each section is like a screen dump – it's a huge chunk of graphics data. The printer reads data from the computer very slowly, taking perhaps a couple of minutes to transfer all the sections. It stores the graphics data in the printer's own megabyte of Ram, gradually rebuilding the image of the whole page. When the image is complete, the printer starts up and reads the image data out of its own Ram very fast, drawing it onto the light-sensitive drum using the laser beam or LCD shutter in about five seconds. A pattern of static builds up on the drum, which then picks up the toner powder and offsets it onto the paper.

Postscript printers use a contrasting strategy. Rather than the Arc assembling the whole page, it transfers only the commands needed to draw the page – write some text here, draw a circle here and so on. The printer interprets the commands and draws the image into its Ram. The net result is the same, but only the drawing commands have to be transferred, not the whole graphics image, so Postscript printers are quicker.

The two new machines represent a third, and even quicker, class of printer: the direct drive laser printer.

Each is built around the same 'laser printer engine' – in fact it's the guts of a Qume Crystalprint that puts the black marks onto paper. The Qume uses a well-tried LCD shutter mechanism built by Casio, not a real laser. Instead of the printer being full of electronics to control the motor, heater, lamp and LCD shutter, it's all controlled directly from the Archimedes. There is just the bare minimum of circuitry in the printer, and the price advantage is clear.

With each machine, an interface podule is needed in the Arc to control the printer timing and data transfer, and there's a tiny matching board in the printer too.

These use the Arc to build up the image of the page in Ram, but whole – not in sections as with the laserjet. The special interface podule makes it possible to read the data out of the Archimedes' Ram and into the printer fast enough to control the laser or LCD shutter directly – the data isn't stored in the printer first. It's read at about two megabits per second, over a hundred times faster than you can manage through the serial port. This gets rid of the main printing bottleneck that slows down laserjet printers – the printer cable itself.



Direct drive printer plus podule: the wave of the future?

Direct drive is also much faster than the Postscript method. The reason is threefold. First the Arm processor in the Arc is faster than the processor in most Postscript laser printers. Second, Postscript prints sprites by sending them as hexadecimal numbers in text form, so it doubles the length of all sprite data. Furthermore, you would normally have to download fonts that aren't built into your Postscript printer, which takes extra time.

Both direct drive printers are also faster for a separate reason – the Acorn printer drivers are very slow at rotating text and sprites from portrait to landscape. The new drivers do this much more efficiently. Computer Concepts has replaced Acorn's font manager with a faster version that's dedicated to assembling printer pages; it uses exactly the same font outlines, so there's no compatibility problem. There's an option to use the original Acorn font manager if you wish. Both printers, with a couple of minor exceptions are truly Wysiwyg.

The direct drive models must build up the whole page image in one go. This takes a lot of memory in the computer, up to 1Mb per page, but both systems compress the image and expand it again when sending to alleviate the problem. Even if you do need an extra megabyte (and neither printer is at all practicable with a bare 1Mb machine), it seems more sensible to have it in the Arc than to have it fitted to the printer where it's inaccessible.

Apart from raw speed, the direct drive printers share other features. As both are built around the Qume Crystalprint, they both carry with them the basic advantages and disadvantages of this machine.

It's a very compact, reliable and slightly noisy printer which produces good laser quality text, notably solid blacks – many laser printers 'fade' the middle of black areas just like photocopiers tend to do. And supplies like the toner and drum are a tad more expensive than some other laser printers; the running costs could be around 4p per page.

On these direct drive (and current Qume) machines, the Qume printer's normal inability to handle heavy paper or letterhead is

mitigated a little: a rear paper-feed for single sheets and envelopes is provided.

The software supplied with both printers means you can print from any application that uses the Risc OS printer drivers – but that rules out some important software. If you're a *First Word Plus* user, or you make use of either the Beeb or PC emulators, then direct drive is not for you. The only way to print anything is to spool your print-out to a file, then print that as if it were an *!Edit* file when you return to the desktop – and that way you're limited to fairly plain text. Furthermore, if you write programs to access the fancier features of your printer using Escape codes – forget it! These are purely and simply Risc OS printers.

The Calligraph ArcLaser and Concepts' LaserDirect are two virtually identical products – although neither the podules nor the printers are interchangeable. They suffer similar problems and offer very similar benefits. So what are the differences?

Computer Concepts' LaserDirect

Concepts' LaserDirect consists of the printer itself, a podule that must be fitted to your Archimedes' backplane, cable, software and a manual. Setting it all up was simple – the Qume Crystalprint is one of the easier 'laser' printers to get going – though the shortness of the ribbon cable between the printer and podule meant the printer wouldn't go in its normal place. Computer Concepts will sell a longer, shielded cable if needed.

The PrinterLD driver software can be installed on the icon bar just like Acorn's own drivers and the software offers similar facilities to the Acorn version. Click Select over the printer icon and a dialogue box offers options like *Quick Text* (Computer Concepts' own *Font Manager* replacement) and a choice between landscape and portrait for plain text printing (from *!Edit*), plus a new option to control the font used for plain text files.

Remember, there are no typefaces built into the printer. While a laserjet uses the printer's own Courier text style, the LaserDirect has to use the Acorn outline Courier (Corpus) – or any other face you choose – to print plain text. The dialogue box uses Concepts' pretty 3D look, familiar to *Impression* users.

The printer menu offers conventional choices like printing to a file, as well as several special items like Show Drum Usage. This clever option flashes the number of pages the printer has printed so far on the printer display. And you can print a test page via the menu too. The printer is entirely software-controlled.

Once the software is installed, printing proceeds as with any other Risc OS printer driver. Select Print from a menu and out comes the paper. Whatever Archimedes printer you're used to, you'll be quite unprepared for the speed of the LaserDirect.

There are two phases to printing. First, an area of Ram is grabbed and the page image is assembled. Then the page is printed – all the data is taken from the Ram and sent from podule to printer in about four seconds. Because the second phase happens 'in the background', the second page can be assembled while the first is printing.

If you have enough Ram, a queue of assembled pages can build up; you get back control of your micro as soon as all the pages have been assembled, while the remainder are still waiting to print. In practice this rarely saves you any time unless you have an Arm 3 upgrade fitted.

During printing, there's plenty of feedback. Lights on the printer flash to show whether pages are being assembled or printed, and the printer display shows how many pages remain in the queue.

The table shows a comparison of times to print several typical jobs; a large sprite, a complex DTP document, simple landscape text and so on. The LaserDirect showed a clean pair of heels to the competition. A couple of minor bugs and inconsistencies showed up during the testing, but these were fixed by improved driver software delivered during the review.

Calligraph's ArcLaser

Setting up the ArcLaser is identical to the LaserDirect – simply installing the podule and plugging it all together, then copying the driver software onto your own disc.

Calligraph's interface podule is much simpler than the LaserDirect, so clever touches like Show Drum Usage are not available from a software command – you have to wait until the printer gives you a warning that the drum is approaching the end of its life.

But the PrinterAL software is functional: you can print to a file for later printing, or even to a sprite, and choose portrait or landscape for plain text printing.

As the table shows, the ArcLaser lags behind the LaserDirect, in part because both phases of printing, assembly and transmission, occur in the foreground. You don't get control back until all the pages are printed and there's no queue of unprinted pages. But it's still comfortably faster than the conventional laser printers. The major drawback of the ArcLaser is that printing is strictly mono. There is no half-toning of sprites; you get greys in Draw files, but not from *!Paint*.

This is a severe restriction if you want the printer for desktop publishing, scanned pictures or any application where sprites are used. Improved driver software will cure this in the future – but this has to be contrasted with the LaserDirect which does good half-toning now.

Conclusion

Hitherto there has been an orderly trade-off between printer speed and price. Both of these machines smash that away by offering faster-than-Postscript speed for less-than-laserjet price.

There is no doubt that the LaserDirect is by far the more polished product of the pair. It works right now, it's slick, it's cheap, and it's fast. Very. If you're buying purely on speed, then this is a clear winner.

But if you're willing to forego a few frills for the moment, then the Calligraph ArcLaser – currently £200 cheaper – could be a steal. It doesn't quite bat in the major league yet due to the lack of half-toning, but improved software is being developed.

Both the LaserDirect and the ArcLaser are likely to appear in other versions, linked to different laser printer engines – for example the Canon LBP-4 – as each of the podules has been designed for easy revision. Computer Concepts includes a programmable gate array to handle the logic, Calligraph a tiny daughter board 'personality module', to make such changes easy.

The software for both these machines should develop. Printing over the network is one area that both companies are looking at. And as well as half-toning, Calligraph plans to include an Epson dot-matrix emulator in its software, which could open up the machine to *First Word Plus* or emulator fans. Buying either machine now won't cut you out, as software upgrades will be free.

Calligraph Ltd, 53 Panton Street, Cambridge CB2 1HL. Tel: (0223) 461123.
Computer Concepts Ltd, Gaddesden Place, Hemel Hempstead, Herts HP2 6EX. Tel: (0442) 63933.

	Calligraph ArcLaser	Concepts LaserDirect	Concepts LaserDirect**	Typical Postscript	Typical LaserJet
Complex 3-page Impression document with pics	2:07	3:20	2:08	8:36	16:34
Quarter page sprite from Paint	0:21*	0:31	0:31	3:04	1:17
Simple 10-page DTP landscape document (no pics)	4:30	10:09	2:22	3:14	66:51
1000 word text from Edit and landscape	0:49	3:02	0:49	1:22	0:46

All times in Mins:secs
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* no halftoning yet. Software upgrade promised soon

Comparative analysis of the LaserDirect and ArcLaser

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BUILDING UP THE BEEB

DAVE FUTCHER looks at a new expansion board – the answer to those memory-hungry Beeb PC programs


Essential's board has just four Ram chips

Ventura Publisher, which operates under Digital Research's GEM 3 interface, on the IBM PC or one of its compatibles is a useful DTP package. Although it lacks a true WYSIWYG interface and any internal wordprocessing facilities, it is used by some professionals, should they happen to be equipped with IBM PCs.

Ventura Publisher is in most ways outclassed by Mac or Arm DTP packages, but they won't run on the Beeb. *Ventura* will – now. The package can run on a BBC Master or a BBC model B, as long as it has an 80186 co-processor fitted that has been upgraded with one of Essential Software's 512K memory expansion boards.

BBC Model B and Master 128 users have, since 1986, had the possibility of running a vast array of IBM PC software on their suitably upgraded 8-bit machines. This was achieved because of Acorn's foresight in designing and producing a 80186 co-processor (also known as the 512 board) as part of the Master computer series. Many BBC owners value the possibility of being able to stay with their BBC, without the need to upgrade to a 'real' PC.

Despite the compatibility of the Acorn 80186 co-processor board there have always been memory constraints running the 512 under the DOS Plus operating system.

This was partly because the memory needs of DOS Plus were 90K larger than Microsoft's MS DOS. There was also the problem that some applications needed as much as 640K running under MS DOS.

This is why Essential Software has produced an upgrade to the orginal Acorn 512K 80186 co-processor. Now a host of IBM PC software packages can run with ease on a humble BBC micro with the Essential Software expanded 80186 co-processor.

As already mentioned DR's GEM 3 will work with no difficulty at all, and that includes everything on the desktop. Version 1.01 of *Ventura Publisher* will work from two floppies with three fonts and provide BBC owners with a useful DTP capability. Industry-standard wordprocessors like version 5.0 of *Wordperfect* run, as does Microsoft's *Word*. The popular shareware package *PC Write* (version 3.1), which allows documents in excess of its original 64K, can cope with up to 400K of text in memory in an expanded 512.

Most versions of *Lotus 1-2-3* happily run on the 512, but with the expansion installed *1-2-3* will use the full memory left after loading DOS Plus. This is rather an exception as most software will not use in excess of 640K, even when it is available.

Earlier versions of Ashton Tate's *dBase* have operated on the original 512, but now the latest *dBase IV* can be used.

A real boon will be the possibility of running *AutoRoute* with on-screen maps and all; but the Tull mouse driver is essential.

In fact anything that was unable to run on the standard 512 because it needed more memory should now be able to run with ease. But don't expect Essential's upgrade to run programs that had been prevented from running on the 512 because of other problems like hardware addressing.

Whatever software you run on your expanded 80186 co-processor, the possibility of exploiting the additional Ram in other ways will be important. Essential Software has thought of this too, with the release of a specialised Ram disc program that enables you to use available expanded memory as a Ram disc.

Problem solver

Shimbumi Software's *Problem Solver* is compatible with the expanded board, which means some of the tricky packages this package has helped before can continue to receive its support. The new board provides continuous Ram.

Essential Software's 512K memory expansion board is not a 'fit it yourself' piece of hardware like a Sideways Rom or Shadow Ram board.

You have to send your 512 board to Essential Software for the company's technicians to carry out the upgrade, as the fitting of the upgrade requires a number of soldered connections.

The expansion is supplied as a complete package, fitted, tested, and with re-programmed Eproms, without which you would lose 128K of the fitted memory.

But there is no need for you to be without your BBC for long. On receipt of a firm order, (including the cheque for £99.00), Essential advises when a 'slot' will be available for your installation. You then send your original 512 board for the upgrade.

The expanded board arrives from Essential Software carefully packed. Once it's out of the wrappings you'll notice that an additional circuit board has been fitted near the centre of the original board above the area where the 80186 processor is located. The new board is actually linked into the main board by full pin connections to the sockets which contained the original ICs 31 and 32, which were control Eproms. The expansion board measures 110x73mm and it has been carefully placed within the external dimensions of the main board.

Surprisingly, the expansion board seems virtually empty of chips. It contains just eight, including the two replacement ICs (31 and 32); the remaining six include the very lastest 1Mbit Drams (four 256Kbit chips), plus two standard decoding chips.

The additional 512K of memory is provided by just four chips – the original 512K board needed 16 chips for the same amount of memory. Fewer chips cuts down power requirements and ensures no overheating.

When you first boot up your newly-expanded Beeb, you may be surprised by the sign-on message which announces 896K rather than the 1Mb you expected. The entire memory space is 1Mb, but the missing 128K is due to the way the 80186 CPU segments memory. In fact, two 64K segments are used for Rom and Tube hardware control.

Conclusions

In use the expanded board behaves just like the original 80186 co-processor, but with the benefit of the extra memory.

Full software packages can be run; there is no need to strip out so-called 'non-essential' parts of some programs to get them running on the 512. Where the 512 Memory Expansion really scores is when running memory-hungry packages like *Ventura Publisher* or *WordPerfect V5.0*.

The 512 Memory Expansion is manufactured by Essential Software, PO Box 5, Groby, Leicester, LE6 0ZB and it costs £99.

Ram disc utilities for the 512 Memory Expansion are also published by Essential and cost £16.95. Owners of the original package for a standard 512 can upgrade for £2 plus the return of the original disc.

COVER TO COVER

Our look at books for this month ranges from a study of the 'computer addict' to the opposite – encouraging children to communicate using micros

Computer Addiction? A study of computer dependency

Margaret Stotton. Published by Taylor & Francis, 4 John Street, London WC1N 2ET. ISBN: 0850667968. Price £12.95.

There you are, sitting at your computer. It's time for dinner, nah, skip dinner. It's time for bed, nah, skip bed. If this describes your evenings then you could be an addict – dependent on your micro.

This is an issue that Margaret Stotton, while observing students with their computers at Loughborough University, thought should be given some serious consideration.

So, what type of person is the computer addict likely to be? Dependents are generally of a shy and introverted nature.

While they are no less ambitious or intelligent than their non-dependent counterparts, they generally feel the need to escape social interaction as far as possible.

The dependent computer user is much less likely to be concerned with an eventual output from their toil. The very thrill of spending hours at a computer is sufficient.

As you would expect, the majority of dependent users are male. Stotton claims this is because women are more interested in the output. To them, the computer is a tool and is used as such. The end result is important – not the fiddling about.

Stotton identifies three categories of addict. Networkers use their computers to communicate with others via modems while workers, on the other hand, are more career obsessed and see the computer as a means of advancement.

By far the largest group of dependents, however, are the Explorers. These are the addicts who program willy-nilly with no concern for the eventual output.

In her conclusion, Stotton asks if computer dependency is a serious problem for either the dependent or his/her friends and colleagues. She puts forward some interesting ideas, one of which is that as computers become more user-friendly the thrill will disappear and so too will the dependency.

For the moment though, it is amazing to see how much computers mean to some people. Why not read this book and see if you could be one of the addicted?

Pauline McLernon

Talking IT Through

Edited by Hilary Kemeny. Published by NCET, Sir William Lyons Road, Science Park, Coventry CV4 7EZ. ISBN: 1-85379-100 8. 80pp. Price: £5.50.

Talking IT Through is a collaborative publication from the National Oracy Project and the National Council for Educational Technology which focuses on the talk which takes place at and away from the classroom computer.

The bulk of the book consists of case studies, nine in all. These come from a variety of different areas of the curriculum, taking in maths, control technology, special needs and multilingual work.

The report on how computers were used in a nursery unit is particularly interesting. The teacher notes, 'The children were making sense of their experiences: talking about their knowledge, using it and making it their own... talking to a computer is a most public way of relating a story, but the children seem to see the experience as a private communication between themselves and the micro.' The observation that pupils find the computer 'neutral and unthreatening' crops up in many of the other contributions too.

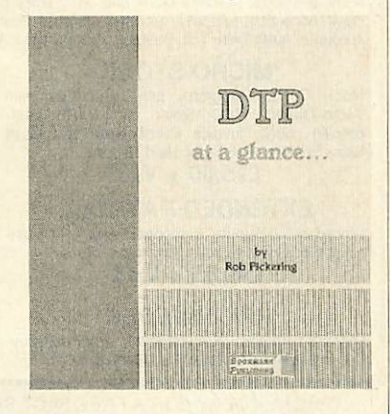
Major features of the book are the transcripts of children's conversations at the computer. Although how speech is represented in text is a matter of some debate, these are fascinating and, of course, essential for the illustration of authors' points.

The software packages mentioned in the text will by and large be familiar to teachers. This is both a strength and a failing. For instance, while the description of the use of the ubiquitous *Granny's Garden* provides useful points of comparison for teachers' own experiences of the program, there are few suggestions about using newer packages which are likely to be effective talk generators.

Firmly labelled as a starting point, *Talking IT Through* does not provide definitive answers but it does raise a number of important issues and provides a valuable stimulus for discussion about the language opportunities offered by computers. It would be a worthwhile addition to any staffroom bookshelf.

Lisa Hughes





DTP at a glance...

Rob Pickering. Published by Bookmark Publishing, The Old School, Bedford MK45 5DE. ISBN 1-85550-002-7. 90pp. Price: £9.95

As desktop publishing becomes more popular, home users try hard to achieve a polished, professional look on paper. But it's all too easy to make your magazine or society newsletter look like a dog's breakfast.

Fortunately, a little knowledge and common sense can go a long way, providing you restrain your wilder urges. Rob Pickering's book *DTP at a Glance* tries to provide a little of that knowledge, and also tries to illuminate the jargon used in the black art of design.

The book is in three sections; loosely, jargon, layout ideas and production. Part one is a thorough explanation of typefaces, point sizes, leading and so on. Basic stuff but vital, and it's well set out.

Part two is meatier, giving you reasons why things are done the way they are. Rightly, it emphasises margins and balance – too many first-timers leave little space at the edge of the page. Part three starts off with a description of the various printers you could use, contrasting dot-matrix and laser output, and then gives strong advice on photocopying, printing and binding.

The book is a good buy for publishing tyros: a slim volume, easy to read and pitched at a low level. There are any number of others just like it, notably John Miles' *Design for Desktop Publishing*, but Rob Pickering's book is as good as any.

It's bundled with Computer Concepts' *Impression* for just this reason. However, I don't think *DTP at a Glance* would be such a good buy as your second book on DTP, and it wouldn't be of great use if you were looking for inspiration for page layout.

Graham Bell

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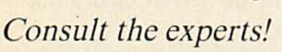


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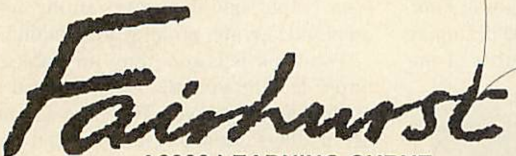
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(See review in Feb '87 *and Aug. '89*)

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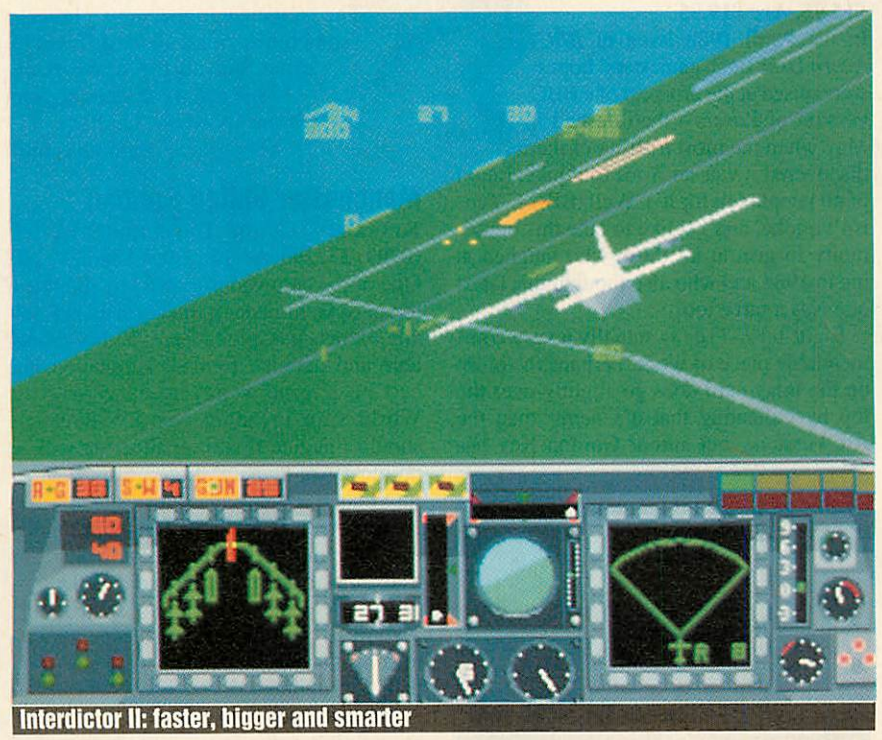
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GAME SHOW


Interdictor II: faster, bigger and smarter

Yes, he's back. After a short break, one of the greatest names in the Acorn games world is back on the scene. Someone who has been in from the start, and made his name through determination and skill. Who? Why, Gary Partis of course (who did you think I meant?). Gary quit the Acorn games scene a few years back for fear that his 'magic' would wear off and mar a good reputation. (Something like 'quit while the going's good' – the sort of philosophy a gambling friend of mine called Mehmet would do well to remember.) Gary is involved with a number of projects and the first is the Archimedes version of *Hostages*, which should get a small review next month.

A quick tip for playing level seven (password 'electron') of *Quazer* from Reza Jugon of Wembley: shoot all but *two* of the ships at the top and they'll begin to feel a little insecure and stop shooting at you!

Exile help is on its way. Almost two years after its launch the little green man has baffled the best of you. Fewer than 10 have cranked the old spaceship into gear and flown off, a victorious hero of glory, back home to fame and fortune (an in-joke shared by the nine or so wry Mike Finns who have completed the game). Thank you to all who have written in begging and threatening and, incidentally, flattery – you should be told – will get you nowhere, (though money might!). I'm sure a special *Exile* Game Show can and will be arranged soon. Watch this space.

Orlando's three-dimensional pool game in which the innovative player operates the table as opposed to the cue will shortly be available from a leading BBC micro games company. The Beeb and Elk versions found themselves at number one in my Top Five of last year and soon the game, with the Archimedes version also, will get a long awaited airing in the Acorn market place.

To my mind *Interdictor* from Clares was a good game apart from the frustrating 'bareness' of the ground and could have done with more airfields. But soon, in a bid to amend these faults, *Interdictor II* will hit the shelves. Clares is claiming that the improvements are the result of comments from reviewers, and since *BBC Acorn User* was virtually the only publication to criticise the original at all – well, just thought I'd mention it.

The scenario has been squared off into an area of 10,000 square kilometers, instead of the long valley which features in the original version.

There are more clusters of hills, which look like hills and not pyramids, irregular shaped lakes, and train routes too! Villages contain houses, shops and churches, and one of the many missions is to wipe out enemy invasions of such places by intercepting their bombing runs.

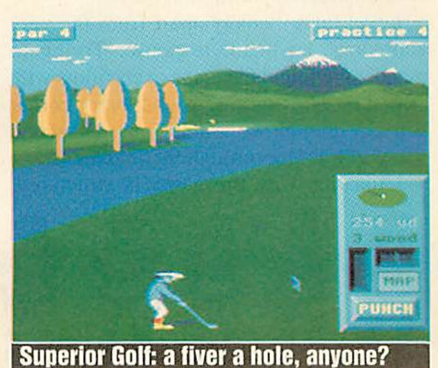
There is a broader range of aircraft too, with bombers, jets and cargo planes. The latter drop trucks full of supplies under parachutes, but they get down faster with a little help from your rocket launcher! The most interesting feature, I think, is the application of an expert system which is being used to operate the enemy, making it in effect more 'intelligent'. All enemy tactics are simulated with a long set of rules, so it won't try the same ideas time after time.

The programmers also claim to have improved on speed and the sequel sells for £34.95 – no change from the original. *Interdictor II* will make its first public flight at the *BBC Acorn User* show in September, where the enhancements will be displayed on a large video screen.

Finally, Superior Software has released a two-in-one golf game and course designer for the Archimedes. In features and play, it's comparable to US Gold's *Leaderboard*, though neither this nor the reigning golf champion *Holed Out* has a built-in hole editor. *Superior Golf* is available now for £19.95, though you'll have to wait a month for the review.

Thanks to Rob Miller for babysitting during the past two months; you're stuck with me from now on. Any hints, cheats, or intelligent comments – you know where to send them.

Sam Greenhill



Superior Golf: a fiver a hole, anyone?



SAS man impersonating an orang-utang

Hostages

Superior Software, tel: (0652) 58585, BBC Cassette £9.95 Disc £11.95, Compact £14.95, Electron £9.95, Arc £19.95

The background to *Hostages* is basic stuff. Some naughty terrorists have invaded an embassy and taken some hostages. As head of the anti-tactics annihilation squad, it is part of your mission to rescue them, but your main aim is to do a lot of destroying and killing. The game is split over three levels. On the first you guide three men to different sniper positions in buildings opposite the embassy. This entails running along the pavement ducking and diving to avoid the beam of a searching spotlight. If it falls across your man he may briefly hear the crack of a rifle before discovering that he can't hear anything else.

Niggle one: if I see him sprawl across the pavement it is clear that he's dead, and a long message to inform me of such is really tedious. Apart from that and the occasionally slow keyboard response, level one passes without fault.

Once in position, the snipers can shoot out all the windows in the embassy, and if a terrorist is in view shoot him at the same time – too bad if a hostage gets in the way. Stupid fool, I say. Extra men are airlifted onto the roof and then, with the protection of the marksmen, begin to abseil down the side of the building to swing through the windows.

Level two is my favourite, because a fair amount of skill is necessary to get all three men inside the building. Once inside, it's a case of shoot anything that moves.

Level three is okay apart from the very annoying keyboard response. Trying to manoeuvre round the maze or corridors with armed psychos lurking round every corner is tricky enough without the quarter second delay in rotating through 90 degrees.

I like the way the game is structured. Apart from there being three sub-games you must complete them all three times with increasing difficulty, thus catering for mixed ability players.

The graphics in *Hostages* are certainly adequate, though the sound is a bit hollow. But I found it enjoyable and addictive, and though it isn't as fantastic as the screenshots may suggest, I would buy it.

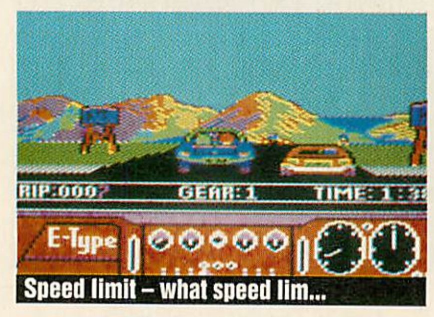
Sam Greenhill

E-Type

Fourth Dimension, tel: (0742) 700661, BBC/Electron Cassette £9.95, BBC Disc £14.95, Compact £15.95, Arc £19.95

In the April 1988 issue of *BBC Acorn User* Beeb gamesters' hopes were raised at the prospect of a BBC version of *Zarch* – then dashed in May when the most trusting of them discovered it was an April fool joke, (and I of all people fell for it!). Well, BBC *E-Type* isn't a joke, and I'd like to take this opportunity to grin at all those who laughed at me in 1988 and who also thought this latest one was a farce too!

Eight-bit *E-Type* is actually a very commendable piece of work. Perhaps the blurb on the inlay card does go slightly over the top by indicating that it's *better* than the Arc version, but author Gordon Key has certainly done justice to the game, not least with the graphics.



Speed limit – what speed lim...

There's not much to describe. You ought to be fully aware that driving games involve little else but driving, and the most proficient of you will have realised that the name implies little else but reckless driving. But where the Arc version stops here *Beeb-Type* cruises on, for the job of collecting time bonuses, boring menial task, has been 'enhanced'! In order to slam brakes on that clock now you must sort-of-accidentally 'slip' and 'bump' into innocent bobbies. Try to forget they may have families, sniff, kids, sniff, a small dog, sniff, a killer Alsatian, (whoops) and hear them squeal as you smash your 5.3 litre 12-cylinder V12 beauty right where it hurts the most (ouch!). As they buckle and die, your sadistic computer awards a healthy time bonus as reward. Who's entertaining who? I found *Beeb-Type*'s semi-automatic gearbox better than the Archimedes', which is only manual or automatic. It introduces skill without compelling the average player to have six fingers on each hand.



On the down side, the five backdrops are remarkably similar, ranging from the green coloured hills of the Broads to the yellow coloured hills of the desert – there isn't much variety.

Also, the longer tracks begin to repeat themselves every few miles, and familiarity breeds contempt rather quickly.

The screen can become cluttered sometimes, making it difficult to drive, but on the whole *Beeb-Type* gets the thumbs up from me. Nice one Gordon.

Sam Greenhill

Manchester United Football

Krysalis / Teque Developments, tel: (0709) 372290, Archimedes/A3000 £24.95

One of the companies tentatively dipping a toe into Archimedes games waters is Krysalis, which has produced a highly enjoyable and detailed football simulation, the best I can recall on any machine. With the World Cup invading our TV screens I should imagine this football game will be on most Arc owners' monitors as well before long.

Here we have a full management simulation of a modern football club, with all its trials and tribulations and an excellent arcade style soccer game into the bargain. Two discs, one for each of these two contrasting but interdependent views of football, are supplied.

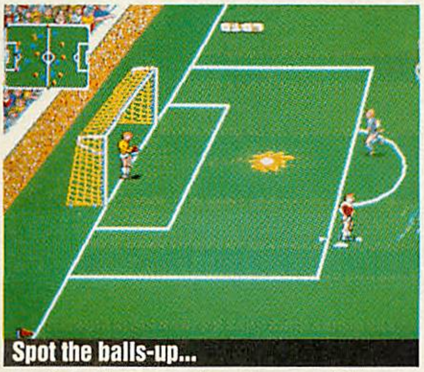
The management section of the game is as comprehensive as you are likely to find anywhere and is presented in the form of a menu system, with large animated 'icons' and digitised footballing pictures in the background. From this main menu, which is accompanied by better than average music (complete with football chants) you can examine and change almost any aspect of running the club.

As team manager, you can see each team-member's form, broken down into its various component parts which include tackling, shooting, confidence and passing abilities, and you can even look at their photographs. Player transfers are well dealt with, and you can buy or scout for players on the transfers list. The graphics are particularly good here when your unwanted player leaves with his boots tied around his neck, or another team's manager appears with a suitcase full of money!

If you select the progress report option, a copy of the Manchester *Daily Sport* is shown, the headline of which shows how you're doing in your new profession. Also

shown are the first three teams on the current league table, covered in more detail in a separate section where it is possible to alter the upcoming fixtures, and even the names of the teams. Your lads are kept in trim by regular (and selective) training in each of the seven football 'disciplines'; passing, tackling, marking and so on. Every member is given a proficiency rating in each of the areas, along with an overall mark based on these.

Also shown on this main screen are lists of players currently under suspension or injured, and yet more menus are available


Spot the balls-up...

to select disc operations (successful teams can be saved/loaded at will) or to set the game preferences (game time, and key definitions for example). Once you've bought your players and supervised their training, you are finally in a position to actually play a football match.

Alternatively, you can simply skip the administration section and get straight on with some real football. One small drawback with this is that since you take the role of one team, two player games are out of the question as far as I can see.

The action side of the game will be a difficult act to follow for future football releases. Instead of the more conventional overhead view of the pitch, you are provided with a novel perspective, as if you were sitting high up in a grandstand of the stadium. The screen is in overscan mode, which means it uses for graphics the area normally taken up by borders.

As the players move around the grass the picture scrolls faultlessly, revealing new sections of detailed crowd graphics and new areas of pitch. The latter is realistically worn and muddy in places and not a uniform baize-green as in some soccer games I could mention. The enlarged screen area really gives a sense of 'being there', or watching the match on TV, and even the corner flags blow about in the breeze. The screen dramatically fades up from black to reveal graphics which have a distinct ST-ness about them. However, they're perfectly good, and using that machine's graphics has in no way spoilt the Arc version.

Sound effects have been kept to a bare minimum, just ball-booting noises and unintelligible grunts from the players, and a prolonged roar of the crowd in the background.

The latter becomes downright irritating after a while and is impossible to turn off, once play has commenced. The motion of the players is smooth and convincing, but it struck me as being odd when somebody moving slowly (often the ref) had his legs going 15 to the dozen! Ball control is very good indeed, and it is easy to pass accurately or administer a sliding tackle.

Both teams' goal-keepers are computer controlled, and their respective skill levels are adjustable from the menu. When a ball happens to slip past one of them a screen appears saying 'GOAL!', which displays a sort of action replay (a few coarse frames of real video).

Both teams' scores and the game time remaining flash intermittently at the top and bottom of the screen – this is not easy to read and can be distracting. The player currently under your control is well indicated by a sort of maltese cross at his feet, and there is a map in the top left corner showing everybody's whereabouts.

There is a hint embedded in the game which makes me think that, happily, there may be more delights on the way from this source. Manchester is currently just about the 'hippest' place in the country to be, and its standing should be improved even further by this excellent piece of software.

Mat Tizard

Play it Again Sam XIII

Superior Software, tel: (0652) 58585, BBC/Electron Cassette, £9.95 Disc £11.95, Compact £14.95

Has it ever struck you that one day Superior Software is going to run out of titles to put on its compilations? That day is drawing closer, but judging from the variety of this current offering, it is still at least a few months off. Here, we are presented with four games – *Barbarian II*, *Percy Penguin*, *Pandemonium* and *Hyperball*; all but the last of which have been scrutinised at some point before in these columns.

Instead of re-covering old ground, I'll turn to *Hyperball*, not really a 'new' game, but actually the latest in a long line of *Breakout* clones.

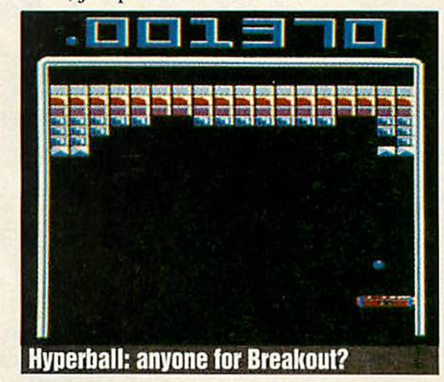
I can't help wondering if, after *Arkanoid*, *Impact* and *Krakout*, the market for such games might perhaps be saturated?

All the best features of those games are here, bar a screen designer, but this shouldn't be held against *Hyperball*, for it contains several neat variations on the old theme, such as an innocent-looking bonus-shaped package that falls from above, only to knock a large hole in your bat! There are six 'Arenas', each containing 20 screens which can be loaded at will and played selectively (provided that you've completed them before). The front end of this game is more than a little spartan, with only the compulsory scrolling message, written in a headache-inducing font, to catch the eye.

An unfortunate detraction from the gameplay is the length of time that your bat takes to appear at the start of each level. A very pretty, but lengthy and irritating, animation is replayed upon each launch of the ball. This is partially made up for by the pleasant dissolving effect when you lose.

The stylish scoreboard with its large chunky digits is very impressive and it means you don't have to squint into the corner of the screen.

All the familiar 'tokens' drop from the bricks as you destroy them and have more or less the usual effects: eight-ball splits, disclosure of invisible bricks, sticky bat, laser, jump-level and so on.



Hyperball: anyone for Breakout?

You are able to buy upgrades for your bat with the credits which you win while playing. These range from a 'Quantum Energiser' to a 'Life Regeneration' capsule.

Although this game comes across as being a space filler for the compilation, its originality and grand total of 120 screens make it good value for one of four games. The best version of *Breakout* ever it is not, but it isn't bad either.

The other components of the compilation – *Barbarian II* with its large and jerky sprites, *Percy Penguin* pushing ice-blocks onto his blancmange-shaped adversaries and Peter Scott's classic arcade adventure *Pandemonium*, combine to make what will doubtless be another money-spinner for Superior. But I get the worrying feeling that, after so many compilations, unless Sam starts to play another tune, in 2020 we will all be playing *PIAS Volume 137*.

Mat Tizard

ALPINE ADVENTURE

Text adventures are perenially popular games for Acorn owners. FIN FAHEY explores ALPS, an Arc adventure designer that lets you roll your own

It amazes me how, in a market as fickle as the games world, the traditional text adventure lives on. Rumours of the demise of text adventuring have come in thick and fast from the 16-bit games scene, where the big thing is the RPG (for *Hostages*-playing Rambos this means Role-Playing Game, not Rocket-Propelled Grenade).

But it always turns out that reports of the old-timer's death are exaggerated. Level 9 and Magnetic Scrolls still maintain a respectable niche in the 16-bit market with their good-humoured, slightly off-the-wall adventures. It's interesting that these two are the only major (meaning global – sorry, Little Englanders) software houses to show any real commitment to the Archimedes.

So the *ALPS* adventure designer from Alpine Software, which might seem like a throwback in the 16-bit market, may get a warm welcome from 32-bitters. The original *ALPS (Adventure Language Programming System)* ran on eight-bit Beebs, being the equivalent of the C64/Spectrum's *Quill* or *Graphic Adventure Creator*.

Upgraded for greater ease of use, the 32-bit *ALPS* aims to be a complete text game designer. Users can assemble their own text adventures and even market them as standalone packages, provided they put an *ALPS* acknowledgement on the title screen.

Open box and remove disk

The package has two aspects. Firstly, it goes out of its way to simplify the process of creating the data and textual matter you need to flesh out a full-scale adventure. The highly conventional nature of adventures helps with this. Secondly, once you have set up your data, it can be manipulated using a formalised sub-set of Basic.

Adventures usually boil down to moving a lot of objects around a lot of rooms in a particular order. This is no condemnation of the genre – it's just like saying that all Raymond Chandler novels are about disgruntled Californian gumshoes. True, but it's what you achieve within the limitations that counts. In this case, setting up the rooms and objects is simple. By clicking on the door and key icons, you are presented with the room and object editors respectively.

The room editor allows you to connect rooms by specifying room numbers for each of the exits. Up to 255 rooms are supported, while room 1 is not available, being the player's pockets (Inventory...) and room 0 is a null area into which you can make objects disappear.

Extra information can be specified for each room, such as flags meaning the room is dark, airless, or any other property you want. A pointer to a message describing the room is also present. Each of the exits can be specified as having properties too – they can be locked, open, invisible or whatever.

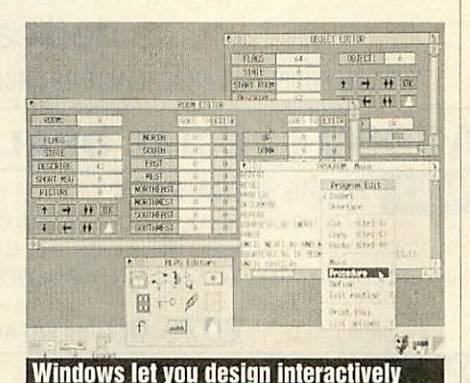
Objects too have their own designer box. Each object can be specified by two words, noun and adjective. The noun can be made to refer to a number of different objects so that, say, while objects 1, 2 and 3 are all keys, 1 is referred to as RUSTY KEY, 2 as GOLDEN KEY and so on. To enter these words in, you need to use the Vocabulary editor, which feeds directly into the parser.

The core of any adventure is the parser. *ALPS'* parser is reasonably advanced and can recognise sentences like: THROW EVERYTHING BUT THE MELON AND THE HAMSTER INTO THE TIME MACHINE THEN SHOOT THE PIANO PLAYER AND GO SOUTH. Each of the parts of speech can be modified and added to by the player. So, in the Vocabulary editor, there are sections for conjunctions, prepositions, 'noise words' (such as articles – to be ignored) and so on.

The other aspect of language is the ability to set up 'messages'. A message is the output you get when you take some action, look around or whatever. Each message is set up using a fairly comprehensive text editor, and each has a number. That number is then used to key the message to something else such as an object, room or action, so a message could be a room description or the result of an action.

Read manual

Assuming that you've set up all your data, the next problem is to tie it all together into a game. This is the part that non-programmers may find a little intimidating. The adventure language used is a very formalised set of Basic procedures.



Windows let you design interactively

The process is simplified because Alpine has included a skeleton starter game to get you going. However it is important to keep careful track of your room and object data – everything is referred to by its number, not by name – and some slight grasp of programming is helpful.

The game can be tested by playing it at any time. *ALPS* games are very friendly to play indeed (see our review of Alpine's own game *Cops* in the last issue) because they make any text visible on the screen available to the player, so you can construct whole sentences by simply clicking on words in descriptions or commands. In addition, you can also drive the game with a series of icons at the base of the screen.

Inventory

I'm moderately impressed by *ALPS*. It contains just about all you need to put together quite advanced adventures, almost up to the Level 9/Magnetic Scrolls level. Alpine has even included a facility for importing graphics from another package, wisely deciding that since everyone has *!Paint* there's no point in including a dedicated utility.

The only thing missing that might bring an *ALPS* game up to professional level is text and graphics compression/decompression. This is what made Level 9's name originally, since it made it possible to get a 64K game into a 32K machine. Alpine is promising, though, to produce an extension disc with this facility, among other things.

Criticisms? Well, it could have been a tad friendlier. Since everything is cross-referenced by numbers, it's easy to get lost. It could also have exploited the graphics potential of the Arc better by allowing the user to display or print a map of their adventure world.

Nevertheless *ALPS* almost succeeded in reawakening my long-suppressed urge to design a set of those good old catacombs.

ALPS, Alpine Software, PO Box 25, Portadown, Craigavon BT63 5UT Tel: (0762) 342510. Price: £33

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NETWORK SERVERS

CHRISTINA NEAL discovers how British Rail is keeping commuters informed, with the aid of a few Beebs



Even though British Rail sports the infamous 'We're getting there' slogan, it's the first to admit that, when trains can't get 'there' on time, information concerning delays isn't always available. Admittedly, most main stations are swift to make apologetic announcements, and also have plenty of staff onhand for yelling at! But smaller, remote country stations are a different matter.

'Many country stations are unstaffed, especially in the evenings', says BR's regional investments manager, Gerald Daniels. 'So anyone waiting for their partner after work has no way of knowing when they will be arriving.'

Apart from being an obvious source of family rows, the situation does little to improve BR's already shaky reputation. So when a firm called BLISS (Booking Lane Information Systems Services) produced a computerised system for relaying information, Daniels was impressed.

'I know a bit about computers as a user and I'm interested in modern technology so, although it didn't run on a PC or have a hard disc, I could tell that it was menu-driven, user friendly and foolproof', he says.

The system – comprised of a Master network – was devised by Bob Brennand, a former long-term employee of Midland Bank's computer division. Although he formed BLISS with the sole intention of producing it, he knew that there were promising rival products on the market. At the same time, he felt that they were too costly and therefore unprofitable for British Rail.

'There have been a large number of gold-plated products which have been very sophisticated and very good', he says. 'But for small, outer-suburban stations, they have been out of reach in terms of being cost-effective. That was the hole that BLISS filled. I wanted to provide a modern system at a good price and with lots of advice and interest from BR, I was able to do so'.

The BLISS system is currently being used at various stations nationwide, including Shipley in West Yorkshire, Telford Central and Ashford in Kent. An emergency version was installed on the Salisbury line in a few days after a previous system crashed.

However, it has proved particularly useful on the Ashford line where small country stations with little or no staff are commonplace. Bob explains how it works:

'The Ashford line has 17 stations, all equipped with Master computers, with an Archimedes 310 in the Ashford signal box. The Arc is the controlling machine where the base of information stems from.'

The Arc sends messages to the other stations via a Tandata modem which dials up the Masters in turn. This enables messages to be displayed at every station on the line, regardless of whether they are staffed or not. The Masters are also self-supporting and can be used as standalone machines.

'The Masters can be used in their right', says Bob. 'This means that if the Arc goes down, they can still be used to display information – they just won't have that link with the other stations.'

'We used mainly Masters because, when I started developing the system, the Arc was an unproven machine. Also, the Master was very sensibly priced.'

Another plus for using the Master is its reliability and sturdiness – qualities that Brennand and Daniels will both vouch for.

'Bear in mind that people using the machines are not trained computer staff,' says Bob. 'They may have come in from off-loading a parcel train, but the Master is a strong, rugged machine capable of withstanding the dust and muck.'

'The system has never failed,' says Daniels. 'It's very reliable. We recently had our first case of vandalism where someone threw a sledgehammer at the screen, but it still hasn't let us down.

I deliberately tried to crash it by doing everything you shouldn't do, but it's virtually idiotproof! It tells you when it won't do something rather than crashing!'

It all sounds easy to use. The clerk has plenty of time to select the line of route, type of message and the four-digit train number. It's all based around the four-digit number that BR carries in the signalling system – something that the staff are obviously very familiar with.'

It all sounds very detailed, but is there anything that Daniels would like to see added to the system?

'Well, we recently added remote control software, which is very useful, and the software is presently being adjusted so that a four-line screen will come up and enable staff to type in the reason for a delay. So rather than just say that the 15:01 has been delayed, they can say it has been held up at 'X' due to a body on the line. That way, people won't get so annoyed!'

Although Daniels is clearly very confident in the system, he is reluctant to say whether it will be extended to cover the entire British Rail network.

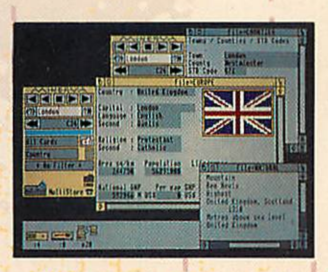
'It's early days yet so I'll answer that question by not answering it,' he says. All I can say is that the system can go to any station you care to select and it really is very flexible. It's also competively priced, although I wouldn't call it cheap and cheerful. I think it's cheap but sophisticated.'

Meanwhile, if you have cause to use any of the lines mentioned, and find yourself reading a message about a dog obstructing the line, you'll have the Master to thank for relaying this vital information.

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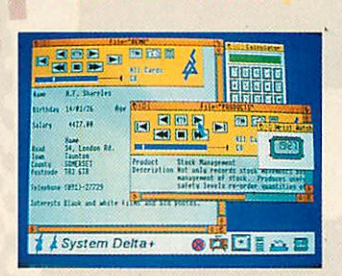
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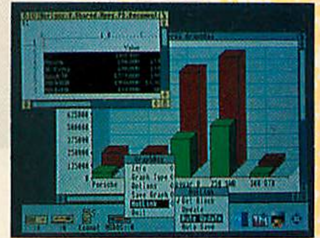


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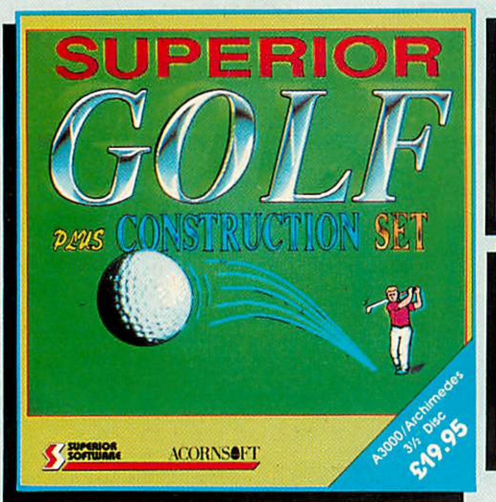
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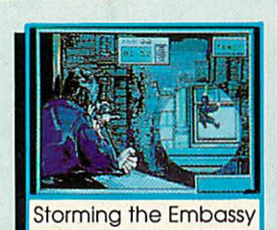
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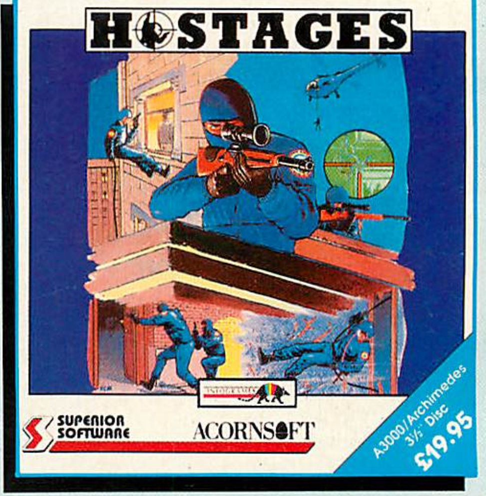
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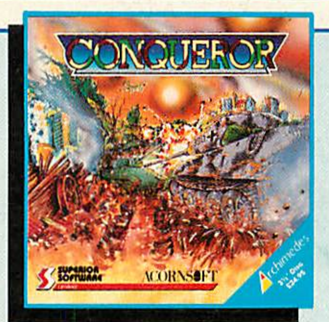


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